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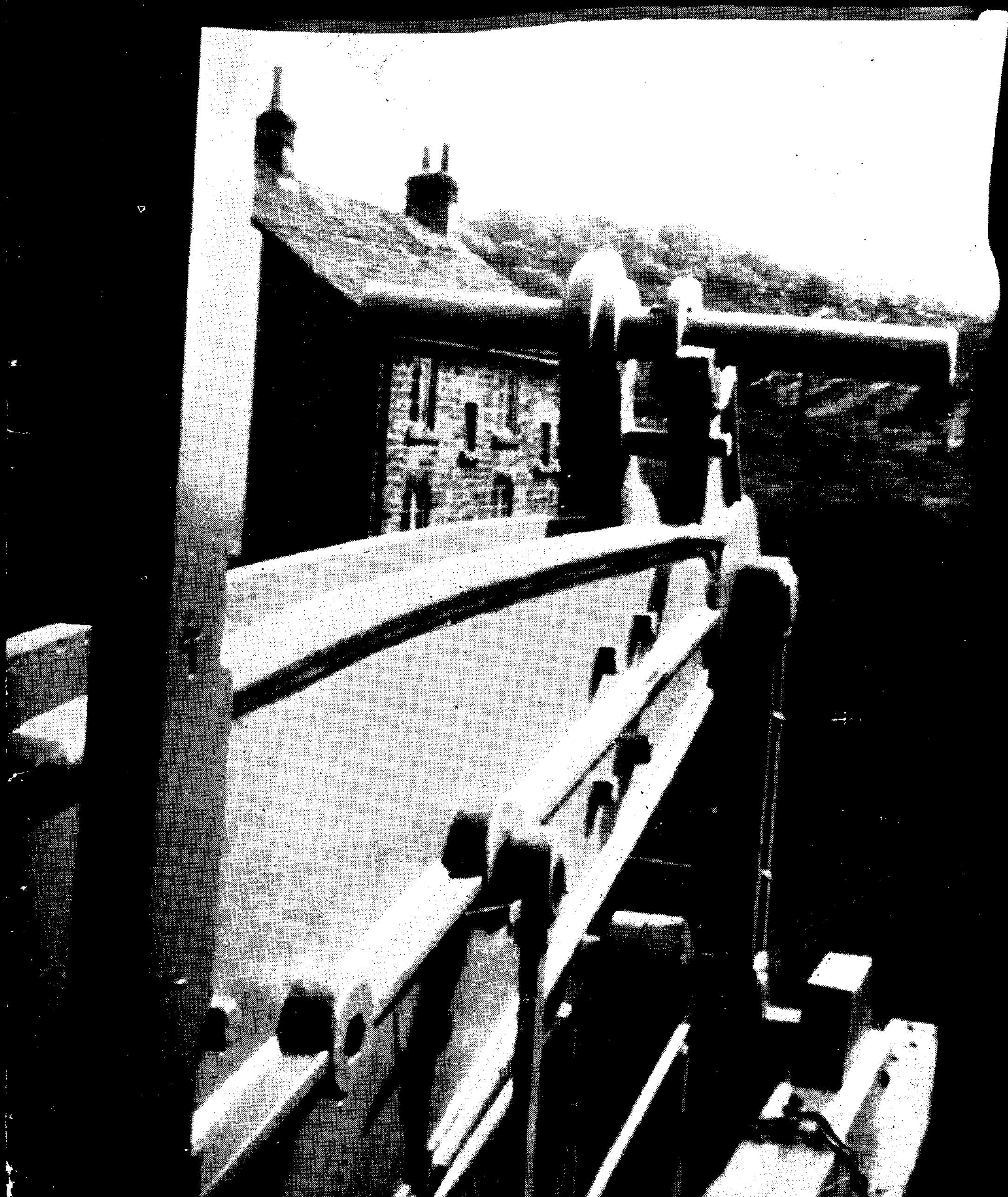
THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

1ST MARCH 1951 VOL. 104 NO. 2597

SMOKE RINGS

Our February 1st Cover Picture

● A NUMBER of readers accepted our invitation to comment upon the picture reproduced on the cover of our February 1st issue, and, not unexpectedly, nearly everyone guessed that the ship was a model. A few readers decided that the picture was a clever piece of photo-montage produced by superimposing a photograph of a model upon another of open sea ; but they were definitely wrong, because nothing but an actual scene was photographed and no faking of any kind was done to either the negative or the print. So here is the explanation :

The photograph was taken at a film studio and depicts a very fine model of H.M.S. *Ark Royal.* She is the work of that past-master of ship modelling, Mr. Norman Ough, and she was floating in a large tank which was filled, literally, to overflowing. The "horizon" was formed by the line of water flowing over the far side of the tank ; the "sky" was a painted background just enough out of focus to be realistic and convincing while clever studio lighting completed the effect.

Some particulars of the model may be of interest : The scale is $\frac{3}{8}$ in. to the foot ; overall length 25 ft. It was made for the Ealing Studios picture "Ships with Wings," 1943. Guns fired, aerial masts were functional, aircraft lifts worked, and there was a smoke generator fitted in the funnel. Two men could be accommodated in the hull. Drawings were prepared by Mr. Ough, who carried out a great deal of the work and acted as chief supervisor.

Exhibition at Andover

● MR. R. PEMBLE, hon. secretary of the Andover and District Model Engineering Society, informs us that there is to be a Festival of Britain model engineering exhibition at the Guildhall, Andover, on Saturday, March 24th and Monday, March 26th. The hours of opening will be 9 a.m. till 8 p.m. on each day. There is, also, a possibility that a combined track day and controlled lined flying display will be held in the Walled Meadow, Andover, on some Saturday during the summer.

Mr. Pemble expects that all societies affiliated to the Southern Federation of Model Engineers will participate in these events, as in the past.

A Loss to Model Yachting

● WE REGRET to learn of the recent death of Mr. J. J. Brown, who was a well-known figure in model yachting circles on the north-east coast. He was one of the founders of the Hartlepools Sailing and Steam Model Yacht Club, as far back as 1902, and was its chairman. Although nearly 80 years of age, he was looking forward eagerly to the club's half-century in 1952.

As secretary of the H.S.S.M.Y. Club, a post which Mr. Brown filled until 1947, he will be remembered by a large number of friends in the north-east, especially for his support of the inter-club competitions, one of which he described in THE MODEL ENGINEER in July, 1911. His death will leave a serious gap among his friends for a long time to come.

Our Cover Picture

● THIS WEEK our photograph is taken from an unusual viewpoint—the top floor of the engine house of the Newcomen atmospheric engine at Elsecar, near Barnsley, Yorkshire. The twin cast-iron beam is seen, with part of the parallel motion. The transverse rod at the end of the beam is a

In this "outside" view of the Newcomen engine, the lowest floor of the house is hidden by the modern building in the foreground

safety measure, to arrest the fall of the pump-rods if the piston-rod should break. A similar transverse rod was fitted at the opposite end of the beam, to prevent damage to piston and cylinder if the pump-rod gave way.

There can be few examples left in Britain—indeed in the world—of the Newcomen atmospheric engine. The one shown in the photograph on this page is the property of the National Coal Board. These photographs were taken by Mr. W. J. Hughes on the occasion of the 1950 summer meeting of the Newcomen Society; he says that the engine is apparently well looked after, and also gives the following particulars :—"It was installed at this mine in 1787, but there is reason to believe that it may have worked elsewhere previously.

"The cast-iron beam shown was fitted some time after installation, the original being of timber with the 'horse's-head' ends. The cylinder is 4 ft. diameter by 5 ft. stroke, developing 13 i.h.p. at a steam pressure of 8 lb. p.s.i. The pump was 18 in. diameter, and raised 50 gallons per stroke at six strokes per minute, from a depth of 129 ft.

After working nearly 150 years, the engine was shut down in 1923, but was hurriedly recalled to service five years later when the electric pumps were overwhelmed. Again in 1931 the veteran was specially steamed for a visit by the Newcomen Society, but this could not be done in 1950, as the pump-rods and the source of steam have now gone."

The other photograph shows one of the main bearings of the beam, which is bolted to a heavy iron casting resting on the heavy timber framing attached to the masonry house. The latter has three storeys; the first originally contained the boiler; the second carries the cylinder; and the third is the beam floor.

Abergavenny Hobbies Exhibition

● WE HAVE received a letter from Mr. E. G. Jackson, who is head postmaster of Abergavenny and hon. secretary of the Hobbies Committee of the Rotary Club in that town. He tells us that members of the local model engineering club have constructed a portable passenger-carrying track, on which 3½-in. and 5-in. gauges are available, and they propose to have it in use at the hobbies exhibition which is to be held in the Drill Hall, Abergavenny, during Easter week, March 27th to 31st. The show will be opened at 2 p.m. on each day.

It is hoped to have as many kinds of models as possible on show, and Mr. Jackson would be glad to hear from anyone in the district who would be willing to show exhibits; his address is "Hay Tor," Wyndham Road, Abergavenny.

A Beam-engine Film

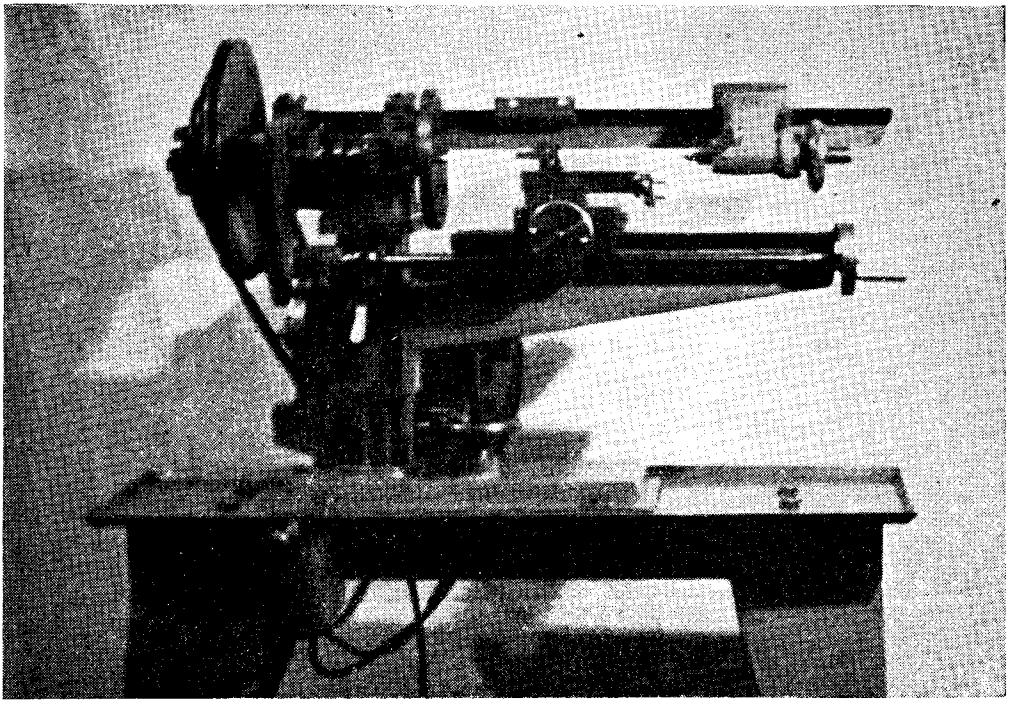
● IT MAY interest readers to know that the Shell film, "The Cornish Engine," is available for showing to clubs and societies. The film can be had in either 16 mm. or 35 mm. size, and applications for the loan of it should be made

The main bearing of the massive beam of the Newcomen engine

to the Trade Relations Dept., Shell-Mex and B.P. Ltd., Shell-Mex House, Strand, London, W.C.2. We have also been advised that a book of the film is shortly being produced by Shell Petroleum Company.

A Free-Lance Lathe

by W. D. Urwick



The machine in its normal condition for general lathe work

MANY years ago, to my great regret, I was obliged to part with a $4\frac{1}{2}$ in. Super-Relm lathe, on leaving home for an engineering career, and it was only recently that I felt its replacement to be a practical possibility. Meanwhile, experience has convinced me that the small lathe has become standardised in design and that the requirements of the amateur's workshop are not necessarily met by a large lathe in miniature.

Some months were spent considering all the information that could be collected on small lathe design, particularly those most interesting articles to be found in the early volumes of THE MODEL ENGINEER. The lathe in the home workshop is an overworked tool and its basic shortcoming, in point of versatility, is lack of vertical movement. The vertical slide and all the weird and ingenious milling attachments that one sees are all designed to contend with this weakness. I decided I would be rash enough to try and build a machine having a cantilevered bed carried on a vertical slide of some sort, so that, if successful, it would at least have a wider application than the traditional machine, and, in fact, be as much a milling machine as a lathe.

Having reached this decision, the final design was conditioned by the following arguments :—

(*a*) A rise and fall bed demanded some separate means of support for the tailstock.

(*b*) For this purpose, an auxiliary fixed bed of T-section seemed to present the simplest machining operations and fewest problems in lining-up on assembly.

(*c*) The only practical position for this T-bed would be to the rear and slightly above the centre-line of the lathe. Here it would not foul the cross-slide with the bed fully raised nor would it cast too much shadow on the workpiece.

(*d*) Suitable brackets to carry the T-section bed would have to be behind the headstock, and would, therefore, rule out normal back gear and belt drive.

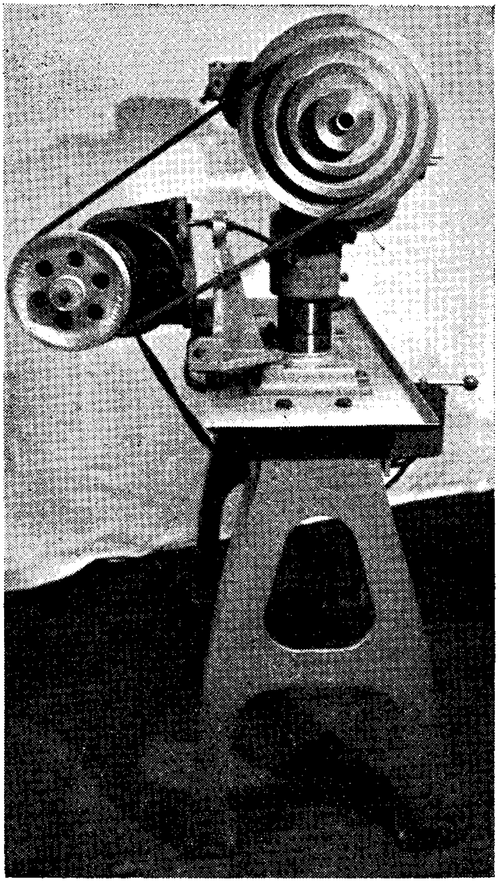
(*e*) At this point the design of the $3\frac{1}{2}$-in. Exe lathe provided the answer, and as I had access to an example in the possession of my friend Mr. F. H. Harmsworth, of Maidenhead, many of this excellent little machine's good points were frankly and enthusiastically adopted. The large outboard pulley and the dog-clutch on the mandrel between the headstock bearings for engaging the changewheels, were obviously the right thing. The ease with which one can change belts and the satisfaction of being unable to pick up the wrong thread in screwcutting make it surprising that this arrangement does not seem to have been more widely used.

It was decided that a ground steel column $3\frac{1}{2}$ in. diameter $\times$ 12 in. high should form the

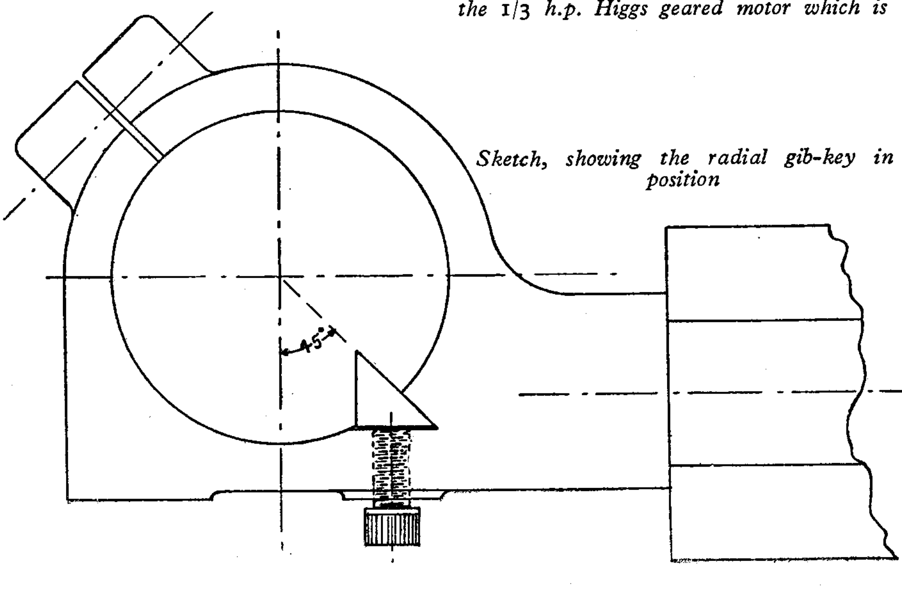
backbone of the machine, as this seemed the simplest way of ensuring that the top surface of the rising and falling bed was kept parallel with the centre-line of the mandrel in the vertical plane. This steel column was faced truly and bored right through to take a long ⅜ in. diameter stud, which was screwed into the underside of the headstock, the latter being also recessed some ⅜ in. to fit over the top of the column. The stud passes down through the column and baseplate, also recessed, and a nut tightened by box-spanner from beneath the machine draws the three parts together. The column is prevented rotating in its recess in the baseplate by an Allen grub-screw and provision for some slight swivelling of the headstock for alignment purposes is obtained in the following manner.

The base of the headstock carries two ⅜-in. B.S.F. Allen screws, each with a 60 deg. point entering corresponding recesses in the column. These recesses are drilled $\frac{1}{16}$ in. out of true in the horizontal plane in opposite directions. By tightening one screw and slackening the other, an extremely fine swivelling adjustment can be made to the headstock in relation to the bed before it is finally locked in position by means of the long stud mentioned above.

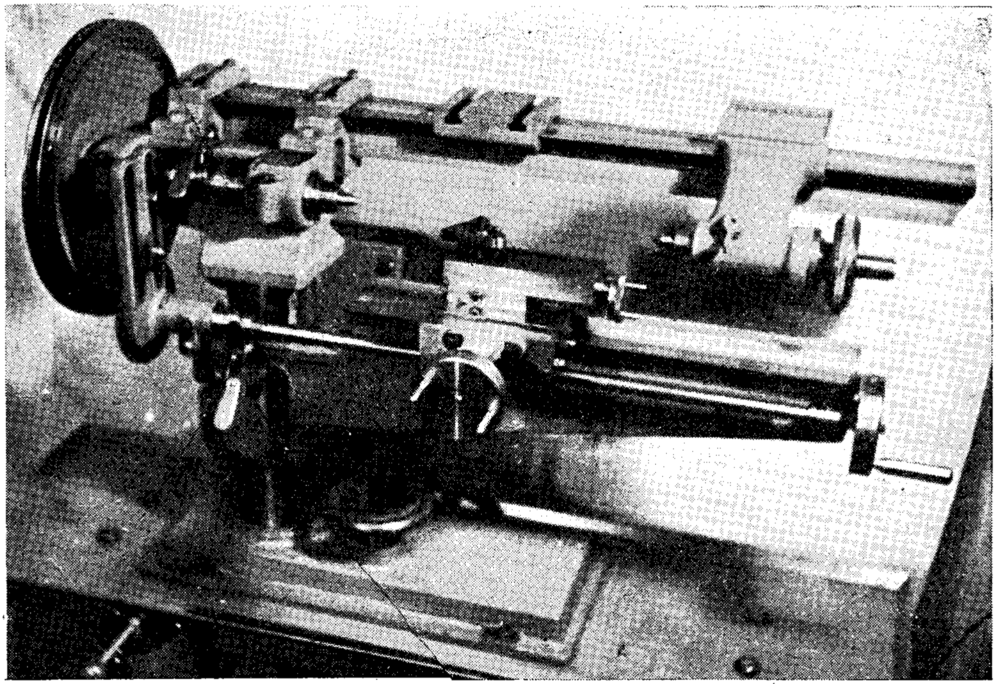
So far as the bed is concerned, it is obvious that the success of the whole machine must depend on being able to maintain the alignment of this part as it is raised and lowered, and to be able to lock it strictly parallel to the centre-line at any desired height. This has been achieved with considerable success by means of the radial Gib-key shown in the sketch reproduced herewith (Provisional Pat. No. 29873/50). As the locking screws are tightened at any required setting of the bed, the two radial faces of the key-ways in bed and column are forced into alignment by the triangular key. In tests with an indicator at the extreme end of the bed variations of the order of 0.002 in. to 0.003 in. were



End view, showing the driving arrangement from the 1/3 h.p. Higgs geared motor which is used



Sketch, showing the radial gib-key in position



Close-up of the lathe proper, to show details

found to be caused by unequal tightening of the two locking screws, and it might be better practice to employ one only at the mid point of the key. Otherwise the device seems to be accurate and to give the desired rigidity.

The tailstock has its alignment in the vertical plane assured, since the tops of the two brackets are ground after assembly to the headstock casting and the top face of the T-bed is forced upwards by two screws against the straps bearing on these ground surfaces. Horizontally, the T-section bed can be adjusted by means of small Allen screws bearing obliquely on the V sides of the two brackets.

These various adjustments present very little difficulty and with the aid of a "Unique" indicator in the toolpost and test bar between centres, the settings can be checked over in a matter of minutes. In any case, this little bit of extra trouble is far more than compensated by the great increase in scope of action with the machine, which is provided by the movement in the third direction.

The following differences from orthodox lathe practice can at once be appreciated :

(*a*) No packing is needed in the toolpost, and any size of tool can be used.

(*b*) The tailstock can pass right over the saddle.

(*c*) The machine can be used like a normal milling machine.

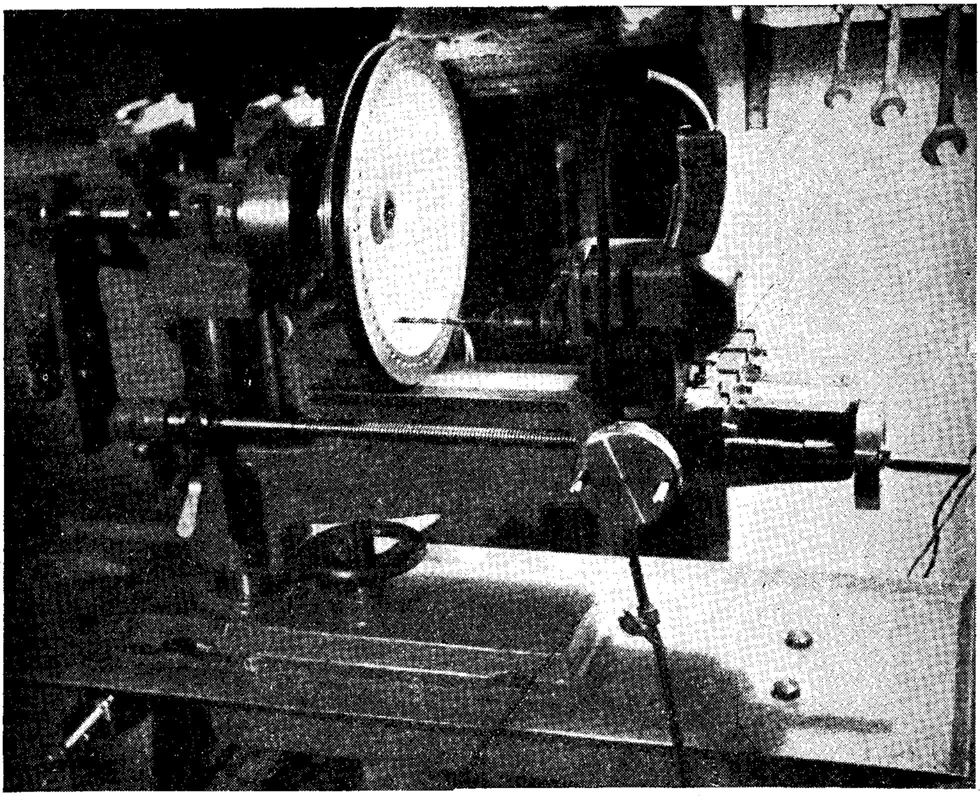
(*d*) By temporarily removing the T-section bed, an awkward job of considerable size can be tackled either in the chuck or on the faceplate. In fact, when the top-slide had been suitably built up to centre height, the boss in the lower corner of the banjo plate was turned, bored and recessed without difficulty. This meant a 14 in. diameter swing over the bed. One of the photographs shows a similar set-up used for marking off and drilling the 60 holes provided in the rim of the driving pulley, which in conjunction with a link-piece, make the pulley into a useful dividing head, as on the Exe lathe.

The tailstock casting was bored without difficulty on the machine itself. It was first drilled and roughed out by mounting it upside down on the cross-slide table and a final cut was taken by adjusting it to slide stiffly along its own bed and then advancing it, by pushing it along with the saddle, towards a heavy boring bar rotating in the three-jaw chuck. Finishing to size was done with an expanding reamer.

The banjo plate and changewheels rise and fall with the main bed, and the former is long enough to allow the wheels to mesh with the driving pinion on the mandrel over the vertical range and to provide auto-feed to the saddle.

It would be quite possible to turn a long piece of work to a considerable taper by removing the Gib-key and slewing the whole bed to the required angle, since the part of the bed casting surrounding the column is split and provided with a locking bolt. Normally, this bolt is adjusted to make the bed a nice sliding fit on the column.

All patterns were home made and I was fortunate in having my own foundry available for the production of the castings. Essential grinding and milling operations were carried out by local



The machine set-up with the bed lowered to the full extent, and T-section bed removed

firms, but much other work was done in spare time on machines, the use of which could be had from friends, and once the lathe spindle was running with a mock-up drive, the remaining parts were finished on the lathe itself.

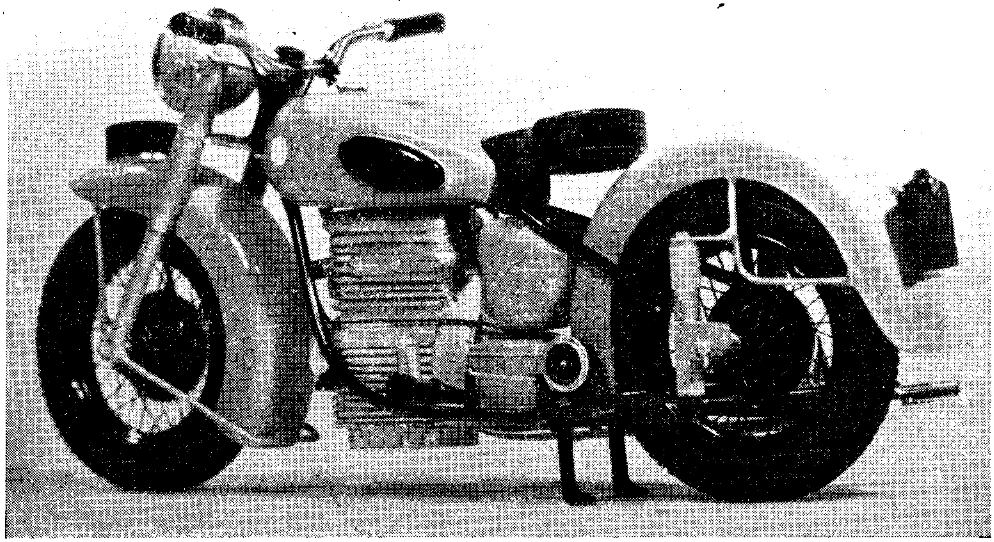
Until this point I have not mentioned the major criticism of the design of this lathe, and that is the obvious and inevitable spring which must exist between the two cantilevered beds. It is indeed possible, by exerting some pressure, to force the ends of the two beds apart by 0.005 in. or more. For all chuck and faceplate work and for turning between centres up to, say, 4 in. length, this spring is unimportant. For long turning, however, between centres an adjustable tie-rod, not shown in the photograph, has been provided to lock the ends of the two beds at any setting. After careful adjustment of the tailstock centre, a trial piece of ¾ in. diameter mild-steel was turned to a high finish for a length of 10 in. and showed an error in diameter over this length of 0.001 in. only.

A small T-slotted table slides on the T-section bed, and it is intended that this should carry a small vertical drill which could be brought to bear on work mounted on the cross-slide. If the Editor can spare the space, it is hoped to give a further report on this accessory in use a little later on.

Although not long completed, and it has taken just twelve months to build, the lathe has, up to the present, proved, if anything, more satisfactory than I had aniticipated and has stood up well to everything it has been asked to do.

The following general specification may be of interest; it will be appreciated that a number of features have been adopted from the 3½-in. Exe lathe already mentioned.

1. Vertical centre height over bed variable between 2 in. and 7 in.
2. Distance between centres, 16 in.
3. No back gear, no countershaft, no rack traverse.
4. Eight speeds, 55 r.p.m. to 800 r.p.m., by belt change only.
5. Micrometers on cross-slide and leadscrew 3 in. and 3½ in. diameter respectively.
6. ¾ in. clearance hole through hollow mandrel.
7. No. 3 Morse taper to headstock with reducing sleeve to No. 1 Morse. Tailstock barrell No. 1 Morse.
8. Dog clutch on mandrel for screwcutting.
9. Dog clutch on leadscrew for self-act.
10. Change wheels 18 d.p. Number of teeth all divisible by three in place of usual five. One 38-tooth wheel converts for a large range of metric threads.
11. Cross-slide table 8 in. × 4½ in.
12. Face of main driving pulley provided with 60 holes which can be used as a dividing head.



BUILDING A MODEL "SUNBEAM" S7 MOTOR-CYCLE

by F. Surgey

As the model Triumph motor-cycle was nearing completion (see THE MODEL ENGINEER for February 1st, 1951, for a description) I decided after hearing the comments of the motor-cycle enthusiasts, that I would build this second model.

As this is of rather unorthodox design I decided to ask the firm if they could supply me with some data. This they kindly did and after examining an actual motor-cycle of this type I prepared the drawings which were once again evolved round the size of the tyres.

As in the previous model, the first stage was the building of the wheels. In this instance both the wheels are the same and are interchangeable, so with the experience gained on the previous wheels and the jig for building same being already made, this difficult stage was simplified considerably.

The mudguards were of heavy section and these were machined from a brass bush as in the previous model.

Frames were soldered together after being built up from brass rod. The telescopic rear fork attachments were turned and fitted to the forks, being held in position by 10-B.A. bolts. A dummy gearbox was turned and the worm-drive section soldered to this for fitting to the rear axle.

Front forks were turned from brass as was the headlamp.

The two tubes were soldered together to the fork pivot plates and small clamps soldered to the top plate for fitting the handlebars through. These clamps were tightened round the handlebars by means of 14-B.A. bolts and nuts.

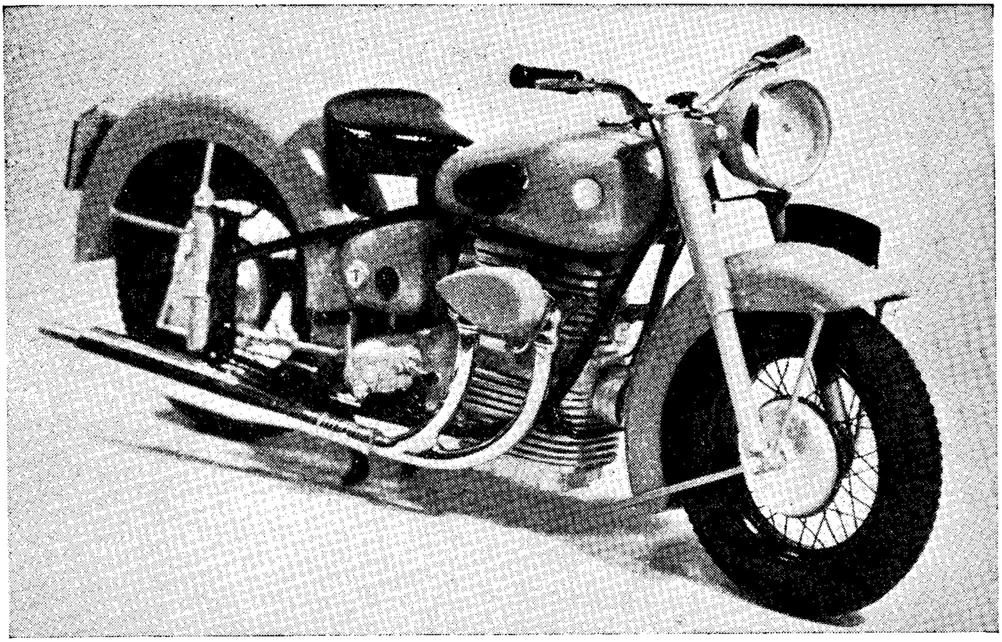
Attention was turned next to the engine and I decided to make this of wood, the various fittings attached to it being made of metal. The fins were cut in the wood block, after shaping, with a fine saw blade, the sump being cut and fitted underneath the engine later.

The gearbox, which is a rather complicated shape, was also formed from wood and the whole unit fitted to the frame. Fittings turned or machined from brass for the dynamo, the carburettor and the plug cover were attached to the engine by means of small screws. A small tool-box was cut from brass, this being fitted to the side of the gearbox. Exhaust pipes merging from twin pipes into a single silencer were made from brass soldered together, the whole unit being chromed after polishing.

The petrol tank and the battery case under the seat were shaped from wood, the instrument and switch being turned from brass. Shanks were left on these parts, which were driven into the holes drilled in the battery case for them.

The petrol tank cap was made and fitted in a like manner. From the engine gearbox to the rear *hub* gearbox was fitted the shaft drive, the dummy couplings being turned in brass.

Wood was also used for the seat which was attached to the frame by means of a bolt and bracket. Other parts were made from brass, and copper wire was used for rear brake rods. Parts like footrests, hooter, gearbox, pedals and other instruments were turned from brass while the stand was cut from sheet brass. The soldering of some of these parts was a very ticklish job, but after melting several parts from their mountings, replacing them with great care, I



View showing the shaft drive side

finally fitted them all in their correct positions.

Cables to the battery case and from brake and clutch handles on the handlebars, were of copper wire, and the handlebars were bent from $\frac{1}{8}$-in. stainless steel. Stainless steel was also used for the kick-start and gear-change levers.

The firm who built the actual motor-cycle supplied me with a small tin of the correct shade of mist-green cellulose, but after painting scrap pieces as an experiment I decided not to use it and employed instead an ordinary gloss paint. This was applied over a proper undercoating and has a very good finish. Silver paint was used for the engine and gearbox. Frame, wheels, seat, etc., are black, while the badge on the tank

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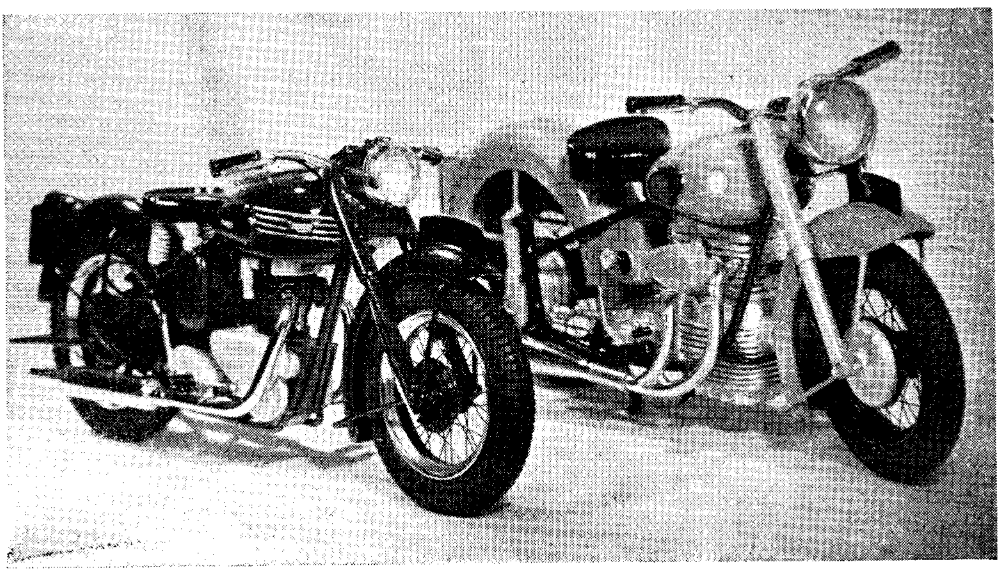


The completed pair

Accurate Slotting of Wide-Head Screws

by W. D. Arnot

I RECENTLY had a batch of screws to slot for the screwdriver, and, on account of the width of the head, it was impracticable to adopt the method described in "Novices' Corner," October 5th, 1950 issue.

One is always rather bothered as to how to ensure that the slot shall be dead central, especially when working to drawings with a stipulated limit. In this case there was a general limit of plus or minus 0.010 in., but it is a peculiarity of engineering and drawing office practice that, although the draughtsman does not specifically state that such a limit cannot apply to the central placing of a slot, he assumes that so much latitude will not be taken in the shop. If it is, you can bet that in a factory, the inspector will at once reject the batch for work of any quality.

I have found a simple expedient that has proved most useful more than once. I take one of those chuck arbors sold for mounting small grinding wheels. On it I thread a washer, true and flat, that is of greater diameter than the slitting saw by a small amount. Having measured the exact diameter of the screw heads to be slotted, and taken the thickness of the slitting saw, I find the thickness of washer now needed to centralise my saw, and make a pair of them. The saw is now threaded on to the arbor between these washers and another large diameter washer completes the mounting, which is drawn up hard by the arbor nut.

When the screw to be slotted is mounted for feeding into the cut, it is positioned so that the large washers just touch, or just clear, the screw head either side, i.e. the saw is centralised by observing equal daylight either side of the screw-head, or, if washer thicknessing has been very accurate, by positioning so that both washers ring as they touch the screw head lightly. Fig. 1 shows the idea.

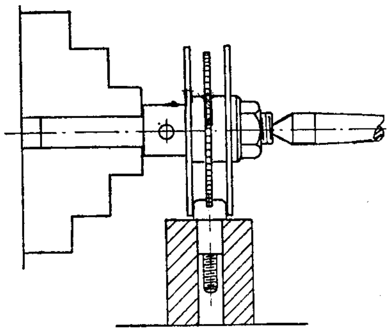


Fig. 1

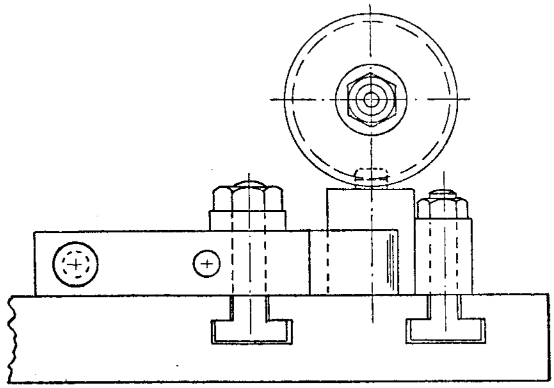


Fig. 2

I use also a quick way to mount the screws for slotting. Having mounted the slitting saw in the chuck, the height of its lowest point from the lathe saddle is taken, that is from the cross-slide. I then turn a piece of square stock to that measurement less the depth of uncut screw head. This is then drilled to take the screw shoulder, then it is hand-slotted to split one side and part way into the other to give it spring.

This holder is placed on end on the cross-slide to which is clamped a heavy pair of toolmakers' clamps, lying on their side and in the jaws of which the holder is positioned. A screw is popped in the holder, the clamp jaws tightened, the saddle centralised under the saw and the cross-slide fed through the cut. As an added safeguard against tipping, I clamp a support behind the screw holder—a bolt in one of the cross-slide slots will do—and take the cut towards the operator, which also suits the usually required saw direction. Fig. 2 shows the set-up on the cross-slide.

These methods ensure a central slot, with a flat bottomed cut square to the screw axis, and identity when cutting a batch of screws of the same pattern.

Building a Model "Sunbeam" S7 Motor-Cycle

(*Continued from previous page*)

is orange. The speedometer in the headlamp has a black background with white lettering and the ammeter in the battery box has a white background with black lettering. The headlamp "glass" was, as in the "Triumph," a wrist-watch plastic disc of the correct size and shape.

Both the machines have been on show and by the public interest in them and the interesting job of building them I have been amply repaid for my work.

Novices' Corner

Some Occasional Turning Operations

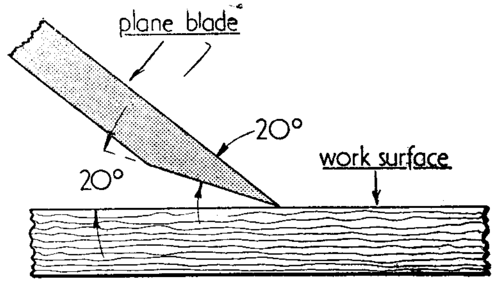


Fig. 1. Showing the cutting angles of a wood-plane blade

THERE are times, perhaps, when most metalworkers find that a piece of wood has to be turned to serve, for example, as a belt pulley. Those who are not familiar with wood turning may try using the ordinary lathe tools, but these are not properly shaped for the purpose and will give a poor finish by tearing the grain of the wood instead of slicing it cleanly. Again, if the hand rest is employed to support a wood

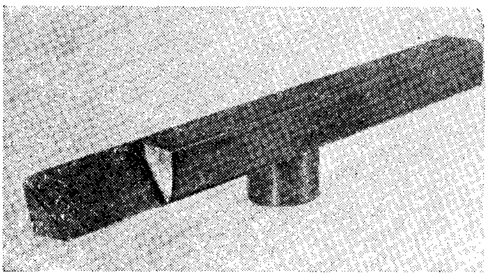


Fig. 2. A lathe tool for wood turning

chisel, difficulty may be found in turning the work parallel and facing it flat. These difficulties can, however, be overcome by mounting a suitable tool in the lathe toolpost and manipulating it in the same way as a metal-cutting tool. If the blade of an ordinary smoothing plane is examined, it will be seen, as represented in Fig. 1, that the lower member of the double iron is formed with a cutting edge having an included angle of some 20 deg.; also, when the blade is mounted in the plane, the bevelled cutting edge lies at only a small angle to the work surface in order to give a shaving rather than a scraping cut. The tool illustrated in Fig. 2 was made specially for wood turning and is used in the lathe toolpost. A length of $\frac{3}{8}$ in. square silver-steel can be used for making the tool, which is filed to shape in accordance with the diagrams in Fig. 3. It will be seen that a side clearance of 10 deg. is given and a like amount of end clearance is provided to enable the tool to cut when traversed along or across the work. Next, after being hardened and then tempered to a pale straw colour, the tool is ground on an abrasive wheel, but great care must be taken at this stage not to overheat the thin cutting edge and so draw its temper. Finally, the tool is sharpened on an oilstone to form a really keen cutting edge like that of a wood chisel. The photograph, Fig. 4, shows the tool mounted in the lathe toolpost and being used to turn the edge of a wooden disc 3 in. in diameter; for this operation, the lathe should be run at its highest speed, and the tool is traversed along the work from right to left. The central recess seen in the face of the disc was machined by turning the tool on its side to enable it to cut outwards from the centre, and although the tool angles are not correct for this purpose, a reasonably good finish can be obtained if a slow feed is used and, above all, the cutting edge is kept really sharp.

Before the work is mounted in the lathe, it should be inscribed with a circle representing the finished diameter and then cut roughly to shape. The wooden disc is attached to the faceplate with two or more wood screws entered from the back, as shown in Fig. 5, and a piece of cardboard is placed behind the disc so that the tool

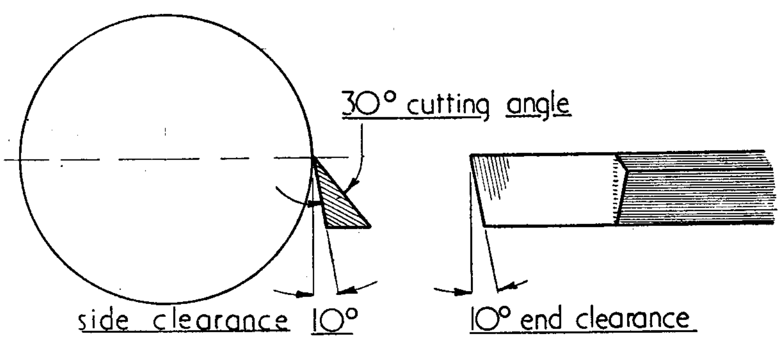


Fig. 3. The blade angles of the woodturning tool

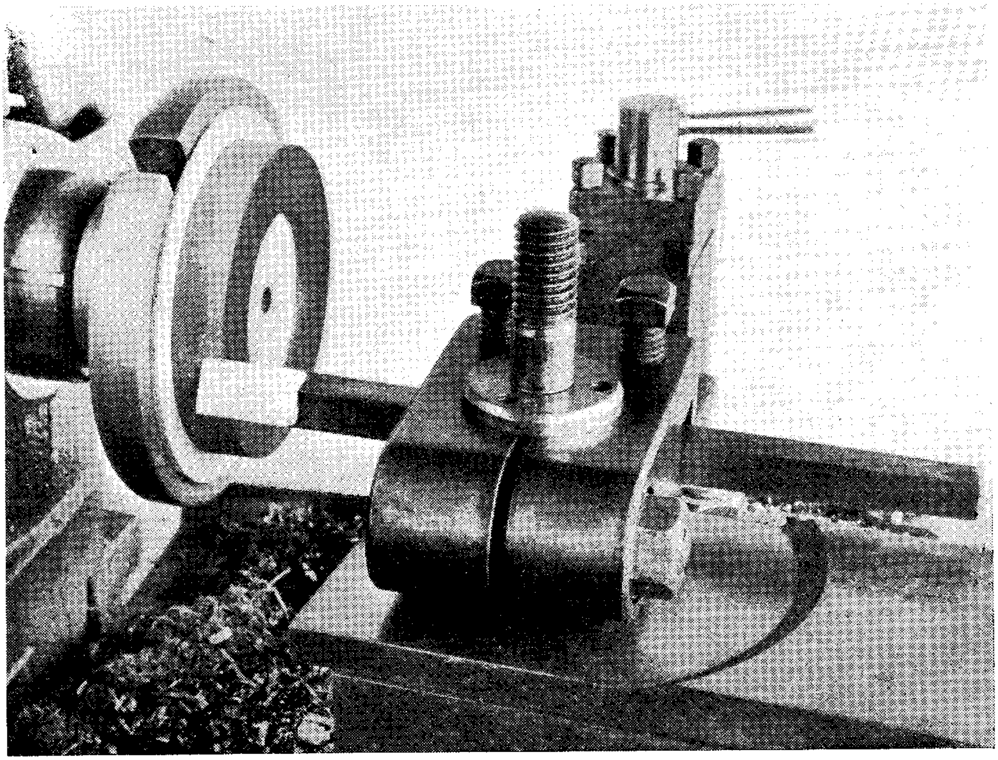


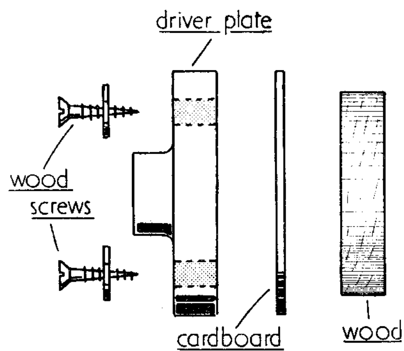
Fig. 4. Machining a wooden disc in the lathe

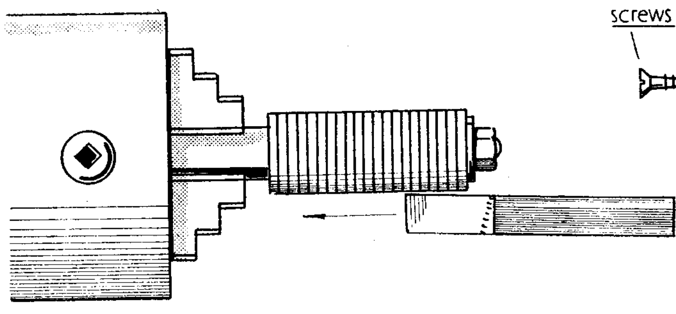
can machine the whole face of the wood without coming into contact with the faceplate. For turning small work, it will be found more convenient to use the lathe driver-plate instead of the ordinary faceplate, but it will then be necessary to drill the plate for the attachment screws. If these holes are drilled neatly and symetrically, the appearance will not be unsightly and the holes will serve on future occasions.

This same tool was also found to serve well when turning a batch of leather washers, where the outer surface had to be made exactly concentric with the central bore. The washers, after being punched roughly to shape, were mounted on an arbor and secured against turning by tightening the clamping-nut. A succession of light cuts was then taken over the pile of washers, as represented in Fig. 6, until they were reduced to the finished diameter.

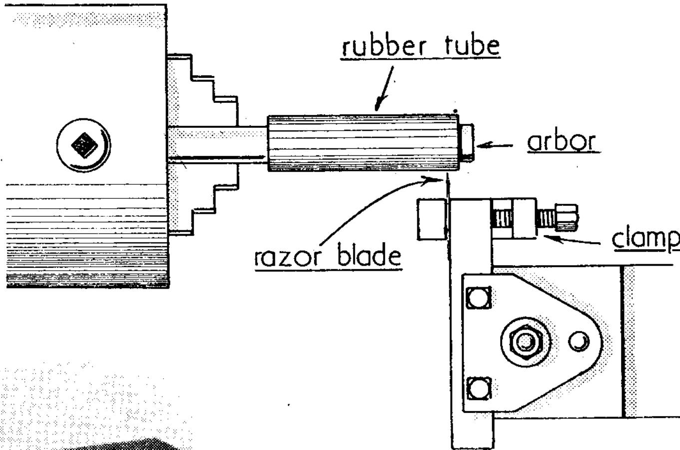
Cutting Rubber Washers

Another job which cropped up recently was to cut a number of narrow rubber washers of

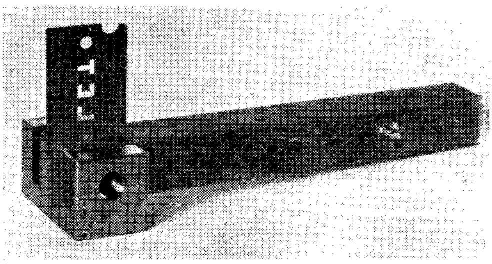




Above—Fig. 5. Method of attaching the wood to the faceplate
Left—Fig. 6. Machining a batch of leather washers



Right—Fig. 8. Method of using the razor-blade parting tool



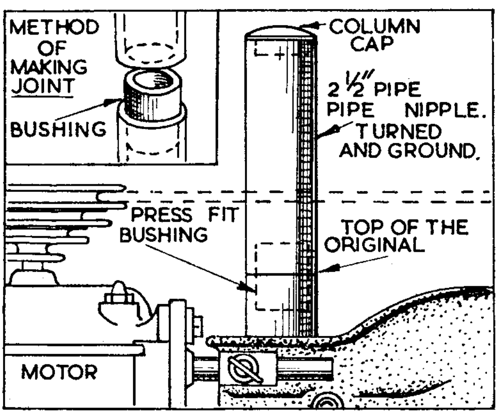
Below—Fig. 7. A tool for parting-off rubber washers

equal thickness. The material used was a length of thick-walled rubber tubing.

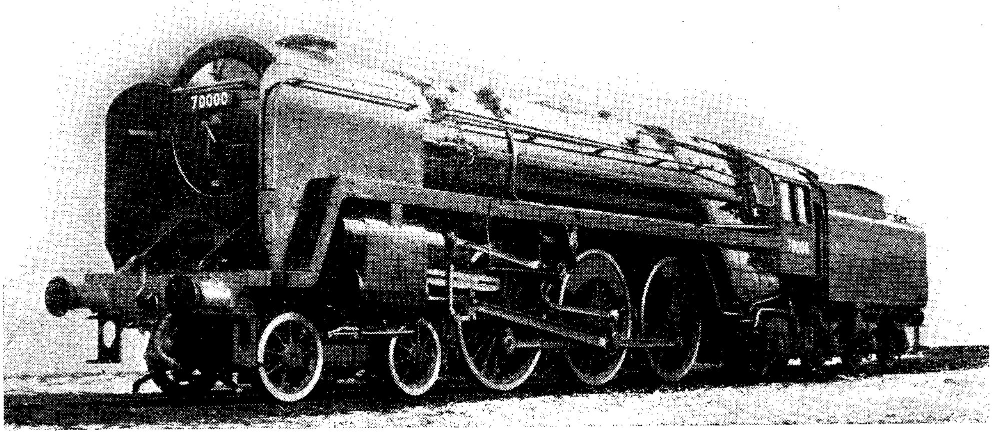
The tubing was pushed on to a length of brass rod, large enough in diameter to afford a good frictional drive; this arbor was then gripped in the lathe chuck. The tool used to part off the washers is illustrated in Fig. 7 and consists of a safety razor blade clamped to the end of a length of $\frac{1}{2}$-in. square mild-steel. This shank is clamped in the toolpost, and the blade is set square with the lathe axis, as represented in Fig. 8. It is advisable, on the score of rigidity, to use a thick blade of the Autostrop type. Parting off the individual washers to the correct thickness is readily ensured by traversing the tool with reference to the leadscrew index. When cutting the washers, they will be severed more cleanly if a mixture of soap and water is applied to the work with a brush. If a brass arbor is used, care must be taken not to damage the cutting edge of the blade by feeding it in too hard; there will, however, be no danger of doing this if, instead, a length of wood dowelling is used for mounting the rubber tubing.

A DRILL-PRESS EXTENSION

THE drawing illustrates how I recently modified a drill press in order that a wider variety of work could be handled, by extending the drill-stand column. A pipe nipple, 12 in. in length of suitable diameter, was obtained. This was then turned and ground to exact size on the lathe. A bushing was then made to fit the column, and the extension was pressed on the bushing. The press-head can now be raised 12 in. higher.



It should be noted that the extension does not interfere or make any difference with regard to work on small jobs. No dimensions are given on the drawing, because, of course, they do not affect the principle of the idea.—A. RICHARDS.



B.R. Standard 4-6-2 Locomotive No. 70000

THE first of 159 British Railways Standard Locomotives to be built in 1951 has just been turned out from Crewe Works. It is a Class 7, 4-6-2 Mixed Traffic Locomotive, No. 70000, named *Britannia.* Like the other B.R. Standard types, which will appear during this year, it has been designed and built under the direction of R. A. Riddles, Member for Mechanical and Electrical Engineering, Railway Executive.

Although Derby is the parent office for the design of this particular type, important sections were designed at Brighton, Doncaster and Swindon as part of the policy of using the resources of all the regional mechanical Drawing Offices to cover the standard types as a whole. Having two 20 in. × 28 in. cylinders, 6 ft. 2 in. diameter coupled wheels, 250 lb./sq. in. boiler pressure and a starting tractive effort of 32,160 lb., No. 70000 is intended for main line passenger and fast fitted freight services of the kind now undertaken by W.R. "Castle," L.M.R. rebuilt "Scot," E. & N.E.R. V.2. Class and S.R. "West Country" locomotives, having equal or better route availability. The combination of two cylinders with a wide firebox, unusual in British practice since Ivatt's "Atlantic" of 1903, exhibits a definite policy to link extreme mechanical simplicity with the largest possible steam-producing capacity, whilst roller-bearings on all wheels are a contribution to high availability.

The first 15 of the 25 engines of this type to be built at Crewe, Nos. 70000-70014, will be allocated to the Eastern Region for service in East Anglia. The last 10, Nos. 70015-70024, will go to the Western Region. Leading dimension and weights are shown in the accompanying diagram.

Boiler

The boiler is the normal design with riveted joints throughout, working at 250 lb. per sq. in. The shell is of high-tensile carbon-manganese steel throughout, and the barrel consists of two rings, the second ring being tapered and forming a true cone. The two rings are rolled from 19/32 in. thick and 21/32 in. thick plate respectively, the outside diameters being 5 ft. 9 in. at the front, and 6 ft. 5½ in. at the firebox end. The smokebox tubeplate is of the drumhead type, ¾ in. thick, and there are 40 large flue tubes 5½ in. diameter outside, 7 s.w.g. thick, and 136 small tubes 2⅛ in. diameter outside and 11 s.w.g. thick. The length between tubeplates is 17 ft. The steam dome contains a "Melesco" centrifugal drier. This fitting separates the water from the steam before entering the steam pipe, thus increasing its dryness before passing to the superheater.

The regulator is of the Superheater Company's multi-valve type and is incorporated in the superheater header fitted in the smokebox. Access to the regulator valves is by a detachable cover in the top of the smokebox. The boiler is fed with water through two separate clack valves placed at approximately 30 deg. on each side of the vertical centre-line of the front barrel. The clack valves deliver on to two inclined trays, which deflect the incoming water round the inside of the barrel clear of the tubes. A steam manifold is fitted on the top of the firebox in front of the cab, and is provided with separate shut-off cocks to each steam supply pipe as well as a main shut-off valve, this being operated from inside the cab. Two direct-loaded safety valves are mounted on the hind barrel immediately behind the dome.

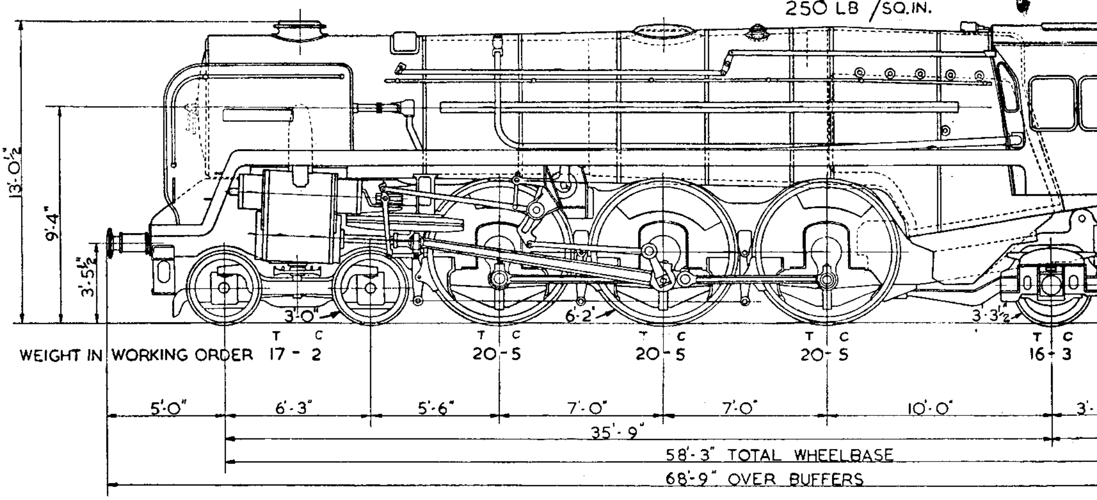
Firebox

A "Belpaire" firebox with wide grate is fitted. The steel wrapper plate is ½ in. thick and the inner firebox is of copper and has a ⅝ in. thick wrapper plate. The front of the firebox is extended into the boiler barrel to form a combustion chamber having a 1 in. thick tubeplate. All firebox waterspace stays are of monel metal, fitted with steel nuts inside the firebox. The roof, longitudinal and transverse stays are of steel, the former being riveted over outside the steel wrapper. The firebox is 7 ft. long outside, the width tapering from 7 ft. 9 in. at the front to 7 ft. 4 in. at the back, giving a grate area of 42 sq. ft. The boiler and firebox are lagged with a light-weight Fibreglass mattress.

A rocking grate is provided, consisting of 12 rocking sections, 6 each side of the centre-line. Each rocking section carries 14 renewable firebar units, making a total of 168 units for the whole grate. The two sides of the grate can be rocked separately from the footplate.

The ashpan has three hoppers, one between and one each side of the main frames, and is of the self-emptying type, having bottom flap doors on the hoppers, connected by a shaft with universal joints and operated by a lever at ground level. Front damper doors on each hopper are opened and closed by screw gear worked from a handwheel on the fireman's side of the cab. This allows a fine adjustment to the air opening to be obtained. Two small doors are provided at the back for cleaning purposes.

The smokebox is of the cylindrical type, resting on a fabricated saddle. The blast-pipe



BOILER BARREL DIAMETER (OUTSIDE)	5'-9" INCREASING TO 6'-5½"
FIREBOX (OUTSIDE)	7'-0" LONG x 7'-9" TO 7'-4" WIDE
TUBES	40 LARGE 5½" O.D. x 7 SWG
	136 SMALL 2⅛" O.D. x 11 SWG
SUPERHEATER ELEMENTS	1⅜" O.D. x 10 SWG
LENGTH BETWEEN TUBEPLATES	17'-0"
HEATING SURFACES: TUBES	2264 SQ. FT.
FIREBOX	210 SQ. FT.
TOTAL EVAPORATIVE	2474 SQ. FT.
SUPERHEATER	718 SQ. FT.
FREE AREA.	6·8 SQ. FT.
GRATE AREA.	42 SQ. FT.

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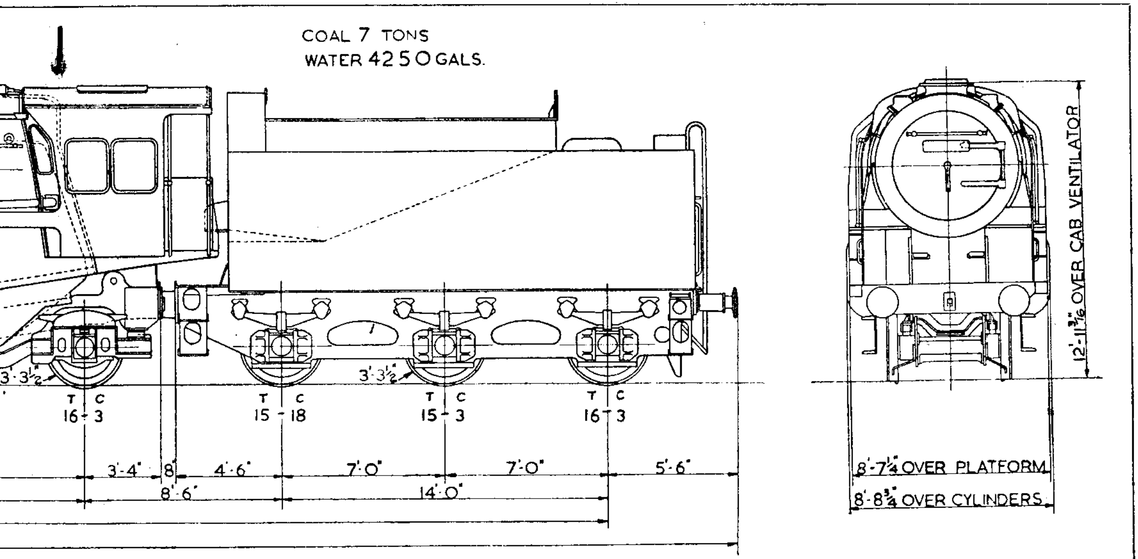
has a plain circular cap of $5\frac{5}{8}$ in. nozzle diameter, which incorporates the blower ring. On the right-hand side is mounted a tri-tone chime whistle, operated from cab by flexible cable passing down the right-hand handrail on the boiler. A stuffing-box on the left-hand side allows the regulator shaft to pass through the smokebox plate.

The main frames are of $1\frac{1}{4}$ in. thick plates spaced 3 ft. $2\frac{1}{2}$ in. apart, the centre-lines coinciding with the centre of the axlebox guide faces. The axlebox guides are welded integrally with frame plates and are fitted with manganese liners. The frames are well braced by vertical and horizontal stretchers and by pin-jointed cross-stays attached to the hornplates. The rear end frame extension consists of two 2 in. thick slabs riveted to the main plates behind the trailing coupled wheels and carrying a fabricated dragbox at the hind end.

A single drawbar transmits the tractive effort to the tender through rubber springs.

Two of the vertical stretchers support the front of the boiler barrel and the firebox front on adjusted brass wearing liners, while the back of the firebox is carried on brackets on the rear extension frames. The side footplating is carried by brackets fixed to the boiler.



CYLINDERS (TWO)	20" x 28"
TRACTIVE EFFORT	32,150 LB
ADHESION FACTOR	4·23
BRAKE % ENGINE & TENDER	54·3
MINIMUM RADIUS CURVE (WITH SPECIFIED GAUGE WIDENING)	4½ CHAINS

WEIGHTS	FULL	EMPTY
	T C	T C
ENGINE	94-0	85-3
TENDER	47-4	21-4
TOTAL	141-4	106-7

SCALE
0 2 4 6 8 10 FEET

Cylinders and Valve Gear

The two outside cylinders are 20 in. diameter and 28 in. stroke, and are steel castings with cast-iron liners, both in the barrel and valve-chest. The 11 in. diameter valves have a steam lap of $1\frac{11}{16}$ in. and lead of $\frac{1}{4}$ in., and are operated by valve gear of the conventional Walschaerts

(*Continued on page 298*)

A CAMERA TRIPOD OF RIGID DESIGN

by R. Harries

THERE are many patterns of camera tripod in the photographic shops ; some are of very good design and others leave much to be desired. Generally speaking, the really rigid models are bulky, heavy to carry around and, therefore, only appropriate to studio work, while the light tubular multi-draw types, although portable enough to carry in the pocket, often suffer from a lack of firmness in the joints, especially after a little wear, thus giving rise to wobble. They are, therefore, only suited to the light camera.

Design Requirements

Wishing to have a tripod which would be rigid enough to support a fairly heavy camera and yet light enough to carry about with reasonable

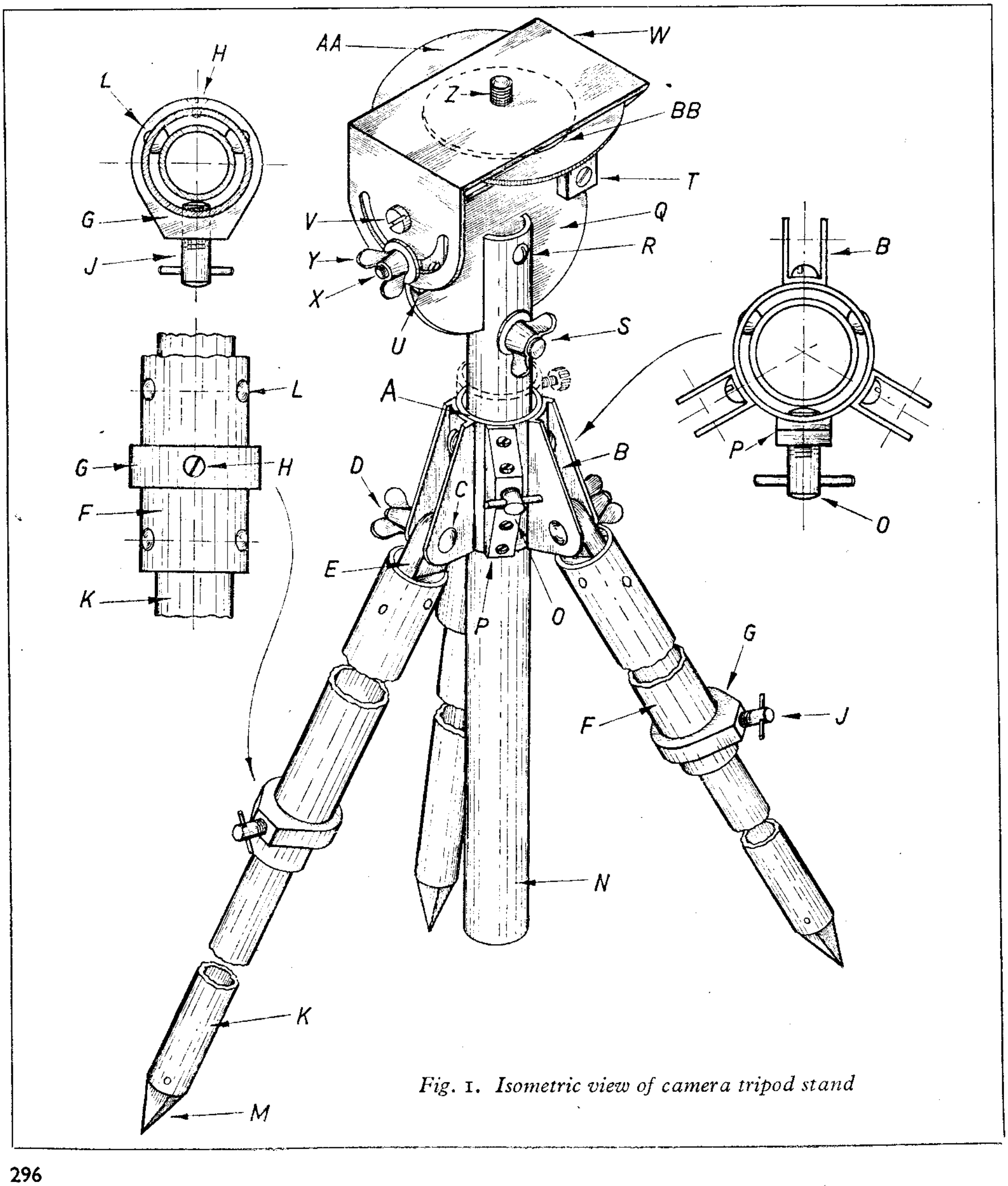


Fig. 1. Isometric view of camera tripod stand

comfort, the writer set about evolving a design.

In determining the latter, it was decided to adopt tubular sections of duralumin so as to provide stiffness as well as lightness, and the union of the different movable sections was to be achieved through true geometric locations so that there should be no distortion due to overconstraining, no wobble due to underconstraining and no possibility of wear introducing slackness into the joints.

is useful for panoramic work, and the second desirable for ease of composing on the screen.

Finally, a completely tilting head had to be incorporated as an integral part of the tripod and not a feature which would have to be added.

A general view of the tripod designed to satisfy the above requirements is seen in Fig. 1.

A short tubular member *A* has screwed to its periphery at three equidistant points the U-shaped brackets *B*, the side wings of which are

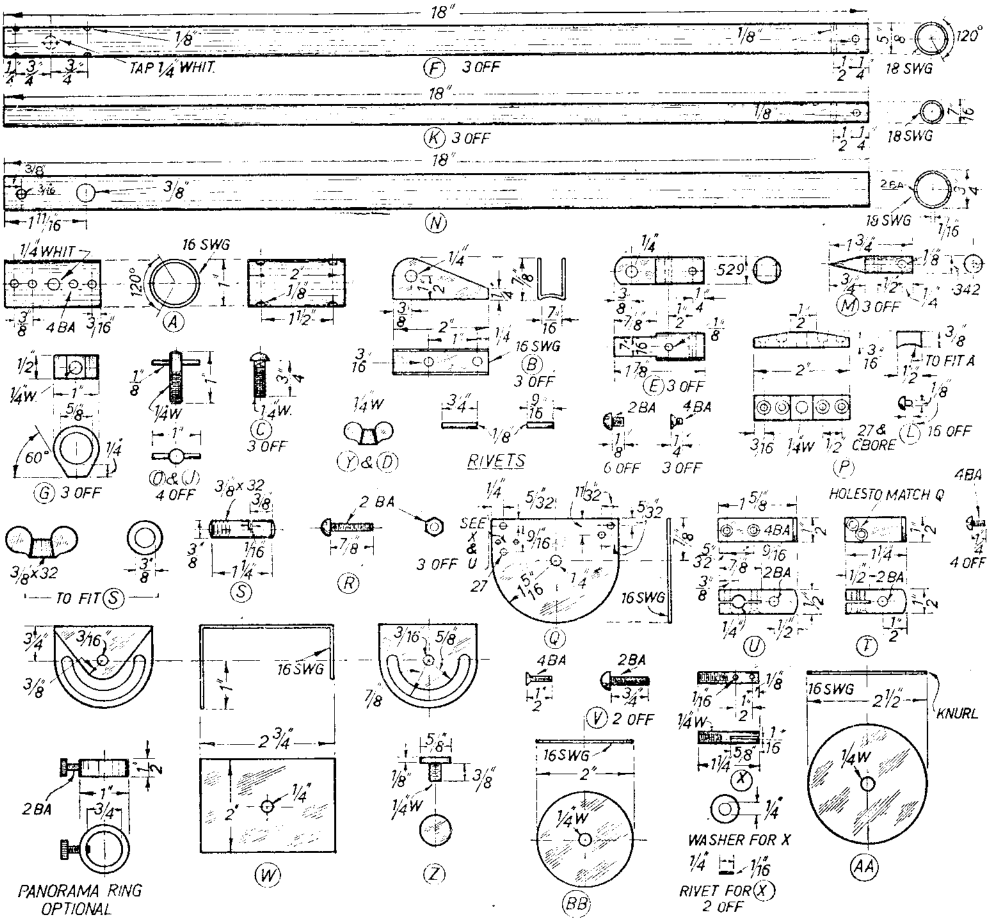


Fig. 2. Tripod parts in detail

Another requirement the writer wished to incorporate was the ability to make continuous height adjustments of the camera, rather than in set fixed movements such as applies to the multi-draw tubular pattern. Further, the capacity to get down really low with the camera for photographing close-ups of small plants at ground level was considered to be important.

A further valuable feature became incorporated in the design incidentally, and that is the facility of swinging the camera about a vertical axis without moving the tripod legs, as well as the vertical adjustment in this axis. This first feature

drilled through near their bottom to accept the screw *C*, with wing-nut *D*. Fitting closely into *B* and swinging about *C* is the plug end *E*. *E* is securely cross riveted into the tubular leg *F* which carries near its bottom end the block *G* attached by screw *H*. *G* is necessary to provide sufficient bearing length for the clamp-screw *J*, the tube *F* being too thin for this purpose.

Sliding inside *F* is the tube *K*, and to ensure a rigid union, geometric locations have been provided inside tube *F*, as shown in the scrap view. Four shallow-headed rivets *L* are riveted to *F* with the head innermost, so that they form

two pairs of raised pads, separated axially by a short distance and individually by an angular displacement of 120 deg. Tube *K* rests on these pads to which it is clamped by screw *J*. The beauty of this simple but effective arrangement is that it is absolutely wobble free, permits complete freedom of sliding of *K* once *J* is released, even if tube *K* is slightly out of round and straightness, and it avoids the expense and even uncertainty of machined fits.

Plugged and riveted into the base of *K* is a piece of rod *M* tapered to a spike end to grip the ground.

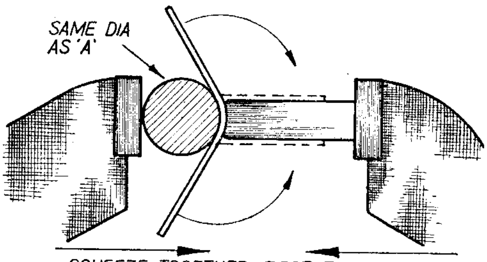


Fig. 3. *Forming item* " *B* "

Returning to member *A*, this has four locating pads on its inner surface like *F*, to provide bearing surfaces for the sliding tubular member *N*, which is clamped by means of screw *O*, entering bearing block *P*. The top of *N* is slit axially to receive the semicircular swinging plate *Q*, which pivots on screw *R* and is clamped by the slotted draw-bar and wing-nut *S*.

At each end of the top edge of *Q* are screwed the slotted blocks *T* and *U*, which are drilled and threaded to receive bearing screws *V* for the swivelling U-shaped member *W*. The front portion of *W* is extended deeper than the back, is radiused on its periphery and has a radial slot through which passes the fixed stud *X* for the clamp-nut *Y* to operate.

Through a central hole in the top of *W* passes the end of a screw *Z*, the head portion of which is soldered to two large circular brass blanks *AA* and *BB*, the larger of which is knurled and acts as a knob to rotate the screw *Z* when attaching the camera. This knob is retained from falling out by virtue of the presence of the blocks *U* and *T* which extend upwards to only just clear the underside of *AA*.

Member *W* has a full 90 deg. swing in both directions, while *Q* has a full 90 deg. swing forward and approximately 60 deg. backwards, so it will be appreciated that the range of adjustment possible is considerable.

Height adjustment of the tripod is secured by splaying out the legs, sliding *K* in or out of *F* and by raising or lowering *N*. *N*, of course, rotates in its bearing, thus permitting camera swing. For panoramic work, an additional collar (shown dotted) fitting around *N*, is clamped at any height so that it rests on *A*.

Really low positioning of the camera is achieved by inserting member *N* the other way up so that the camera hangs upside down between the three legs.

Notes on Construction

While this tripod can be made in any size to suit individual requirements, the dimensions of the detail parts shown in Fig. 2 are for a model fitted to general needs. All items are of duralumin with the exception of parts *B*, *W*, *AA* and *BB* and the various screws which are best in brass.

A lathe is not vitally necessary for the construction, but is valuable for fitting the plug ends and milling the sundry slots. The bracket *B* is shaped over a form block, as shown in Fig. 3.

The heads of rivets *L* should be reduced in height as necessary to bring tube *K* approximately central with tube *F* when seated in position. Similarly, adjust the rivets in the tube *A*.

B.R. Standard 4-6-2 Locomotive

(*Continued from page* 295)

type, giving a travel in full gear of 7¾ in. and full gear cut-off of 78 per cent. The slidebars are of the three bar type with underhung crosshead.

Lubrication of motion pins is by grease nipple and gun, those for the reversing shaft and expansion link being grouped together on the motion bracket. The eccentric-rod big-end runs on a " Skefko " self-aligning ball-bearing. Valve and cylinder lubrication is by atomised oil delivered by mechanical lubricators. Steam-operated cylinder cocks of large diameter are fitted for quick draining of the cylinders of water which may accumulate.

Reversing is by handwheel and screw, the latter being situated at the reversing shaft lever, and rotated by a tubular shaft from the cab. A drum type cut-off indicator is provided and the operating wheel is placed parallel with the longitudinal centre-line of the engine.

Cab and Fittings

The cab structure is carried by cantilever supports attached to the firebox backplate and by a diaphragm plate at the dragbox, this arrangement allowing full freedom for the cab to move with the boiler as expansion takes place. All boiler fittings and pipes are kept free from the main frames to avoid differential expansion and secure freedom from fracture due to this cause. For this reason, the exhaust injector on the right-hand side and the live steam injector on the left are carried on brackets attached to the ashpan and foundation ring.

The steam and water controls for both injectors are operated from the fireman's side of the engine.

The photograph at the head of this article, shows No. 70000 in black workshop livery before trial.

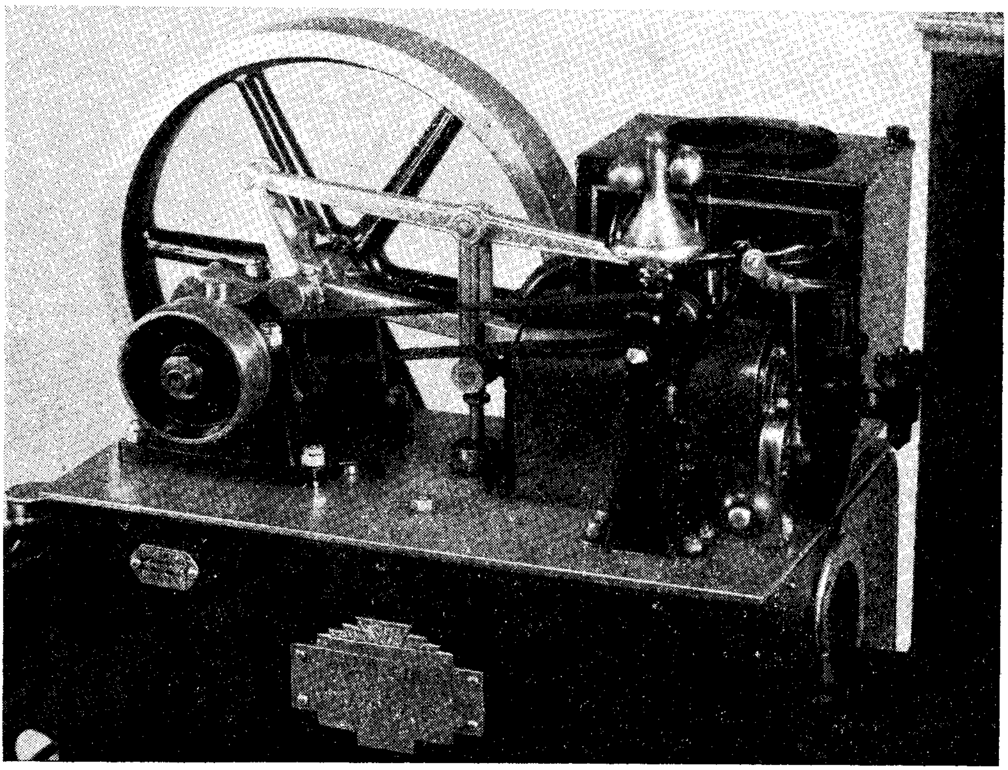
*A SPIRIT-FIRED HOT-AIR ENGINE

by Mark Wyer

SUPPORTED clear of the baseplate, as described in last week's issue, was the brass water tank, $3\frac{1}{4}$ in. × 2 in. × $3\frac{3}{16}$ in. high, which has an oval opening at the top. The upper water connection was jointed by means of a rubber sleeve, with an elbow sweated in $1\frac{1}{4}$ in. below the top edge of the tank.

Made from one piece of 20 s.w.g. black sheet-iron, folded to shape and riveted, was the heat chamber and main casing, dimensions 8 in. × $5\frac{1}{4}$ in. × $6\frac{1}{2}$ in. high. A section was removed to provide space for the flywheel, as shown in the photographs. Thin aluminium in sheet was bent to form a U, and this was fitted point uppermost at an angle in the chamber, rising from the rear end to the top edge of the chimney opening. Insulation was achieved by lagging with thin asbestos sheet, held in position by screws and nuts, all round the casing, thus forming a heat deflector. A $3\frac{1}{2}$-in. hole flanged in a central position in the heat deflector allowed the entry of the regenerator cylinder.

Immediately to the right of the door opening, a flame deflector passed across from front to back of the chamber, 2 in. high above the base. At the rear end, above the heat deflector, a 2 in. diameter opening was made, as was another of 1 in. diameter in the chimney, both being covered with gauze, to ventilate the upper half of the chamber.



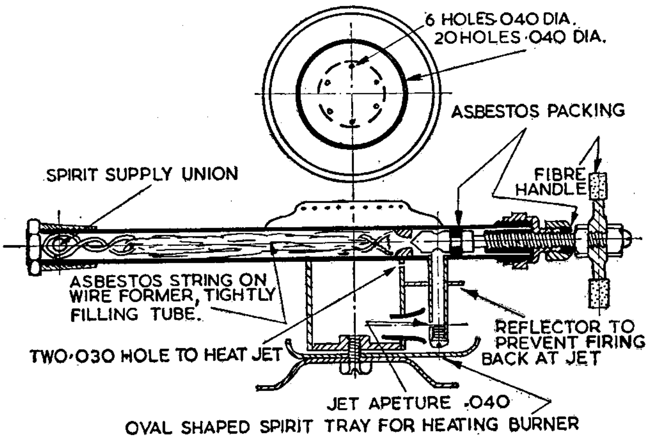
Close-up view, showing controls and governor details

The door itself was so arranged to enable one to manipulate the control valve of the spirit burner, which passed through a slot at the back of the chamber.

The chimney was made in much the same way as the casing, 20 s.w.g. black sheet-iron was bent and riveted, and flanged to suit the front end of the casing. A cap, made from brass angle pieces, and an $\frac{1}{8}$ in. thick square washer cut to size, were silver-soldered in to complete the chimney.

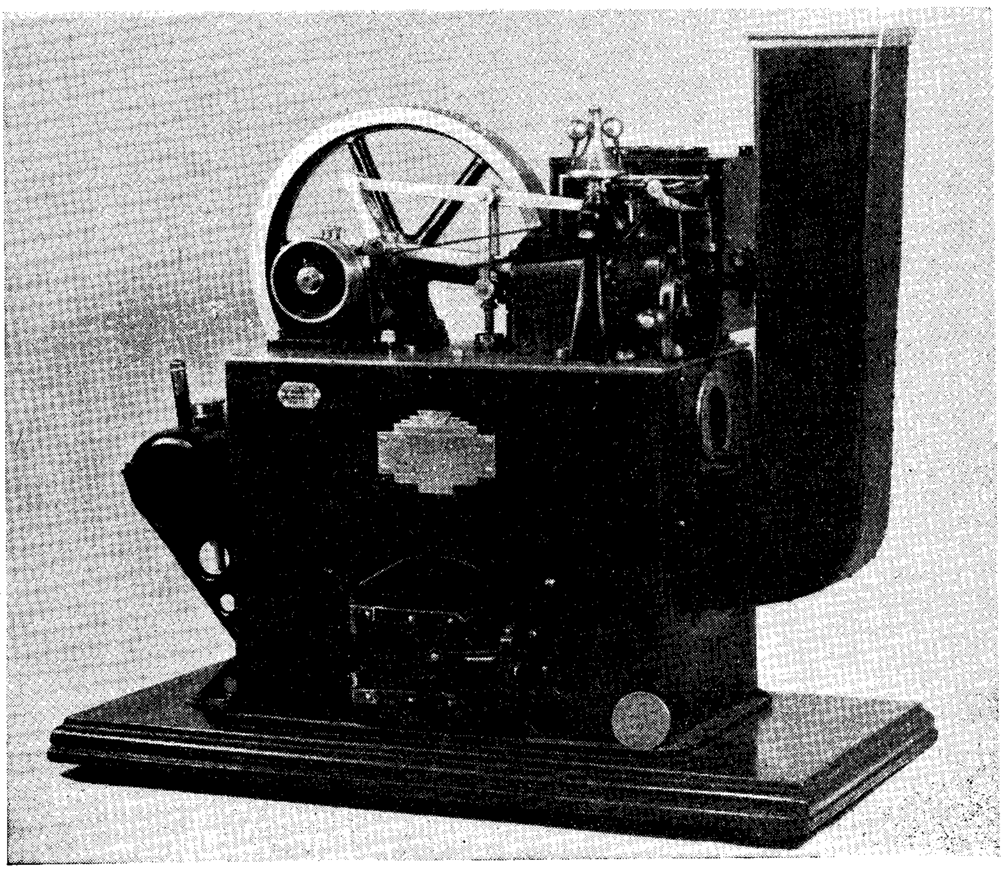
The methylated spirit burner, as shown in sketch, was decided upon as the best after many experiments on other models; it was found to

**Continued from page 256, " M.E.," February 22, 1951.*



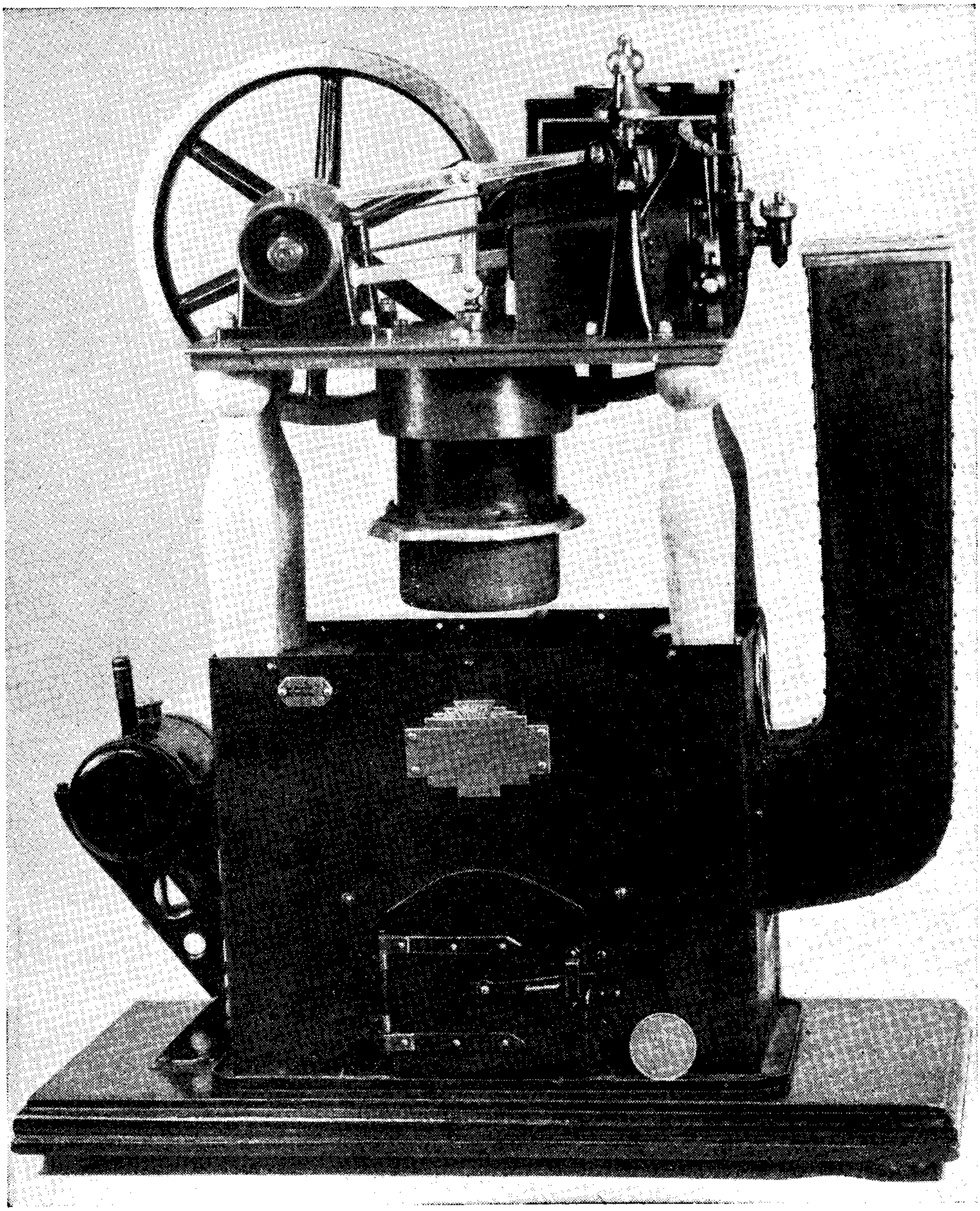
The methylated spirit burner

be quiet, not liable to surging, and capable of a wide range of control. Above all, it allowed the engine to be run at a very low speed. The spirit burner was fixed as a separate unit in a flanged tray, which fitted over the whole engine casing, with fixing points on the baseboard, flanged to make it completely "spirit tight." Also fixed to the baseboard was the supply tank, in order that, if required, the engine could be lifted clear. Gauging of the spirit level in the tank was effected by means of a rod attached to a hinged float, the rod being exposed to view by removing the top of a small cylindrical extension on the tank, which also acted as a vent for the tank.



Rear view, showing spirit tank

The governor was patterned on a well-known type with an enclosed return spring, and was constructed mainly from hard bronze, being driven by $\frac{3}{8}$ in. diameter bevel gears. The balls were of the same diameter, and the vertical shaft, hardened and polished, was supported by a $\frac{1}{8}$ in. diameter steel-ball acting as a thrust bearing to take the weight of the rotating parts. This governor operates on the top end of the control piston, through a lever which is pivoted at the centre on a fulcrum pin, which also carries a hand-operated lever. By this means the speed can be controlled by hand below the governed engine speed, but the maximum speed is still under the control of the governor. Engine speeds range from 250 to 1,250 r.p.m.



Engine lifted out of casing to show the regenerator cylinder and copper water jacket, and the flanged 'oint between upper and lower parts of the cylinder

The baseboard was of mahogany, $\frac{3}{4}$ in. thick, mounted on four rubber feet, and carried brackets to hold the fuel tank, and also a centrally mounted fitting for locating the spirit burner under the regenerator cylinder.

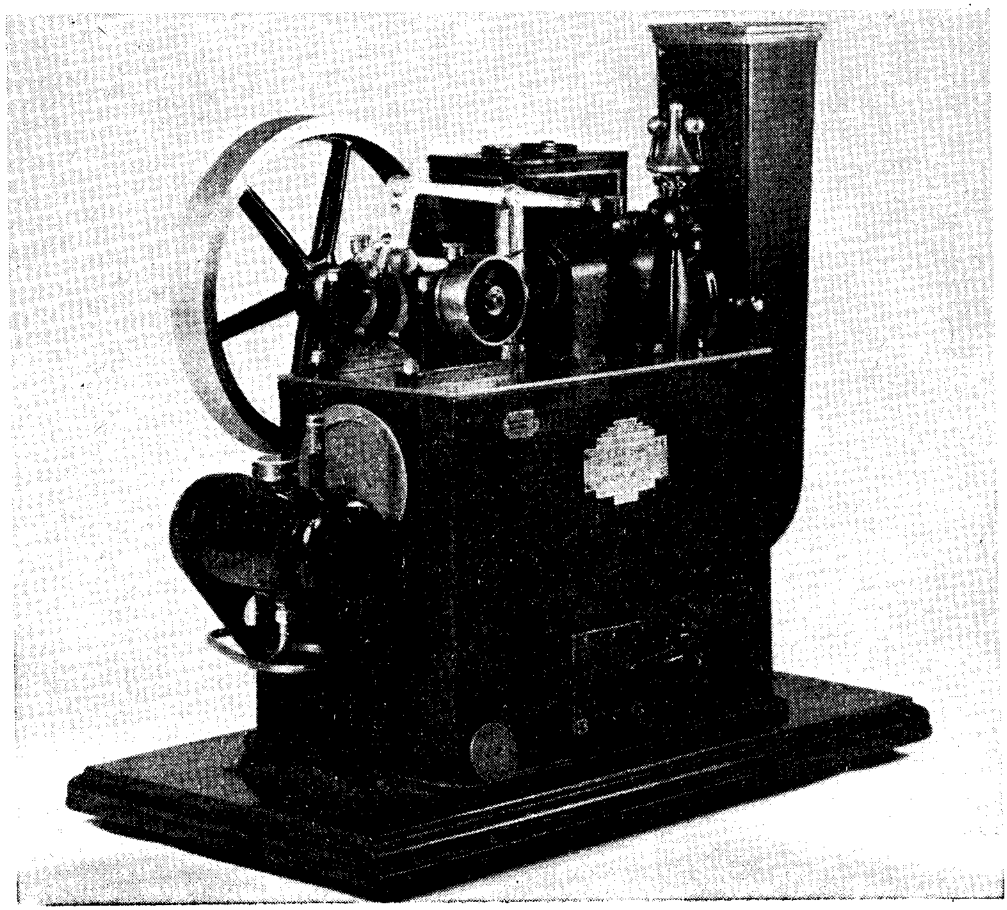
As regards finish, the black parts were treated with two coats of stoving enamel, with a few bronze lines. By diluting this same stove enamel, the main casing and chimney were given an almost transparent finish, thus preventing corrosion, but still allowing the original black finish of the iron to be seen. All parts of material other than copper, which would be in contact with water were tinned during construction, and the duralumin levers, flywheel rims, pulleys and all bronze parts were polished.

With regard to choosing a fuel, the final choice of spirit was due mainly to the fact that although coal gas is probably a better heat source, it is not always on tap, being especially absent when one wishes to " show off " the engine away from home. Therefore spirit has been used, and fumes and smell have been obviated by the use of a large heat chamber and tall chimney.

It is essential that all engine parts should be made to run perfectly freely, so that when cold, the engine will oscillate, or bounce against the air in the system, similarly to a car engine in the compression stage. One should not forget that although the cylinder is open-ended there is a pressure outwards and a suction inwards.

I have found that using a vertical regenerator cylinder and a displacer piston is superior to that of using a horizontal type, as in the latter case the overhang on the piston is very great at the outer end of its stroke, causing much friction in its guide, which is therefore difficult to keep oiled. In the vertical type, with a water-cooled guide, this does not happen, and the weight of the displacer and rod can be balanced by the disposition of the crankshaft webs, or by adding weights to the flywheel. Again, with regard to the heating of the vertical cylinder from below I feel that it is advisable to heat from the centre, and allow the flame to spread outwards to the edges., it is my opinion that much research could be made into this particular problem, especially as concerns the use of such materials as Monel metal.

I hope that this may prove the incentive for other model makers to advance further on these lines than I have been able to do ; always bearing in mind the old motto : " Whatever is rightly done, however humble, is noble."



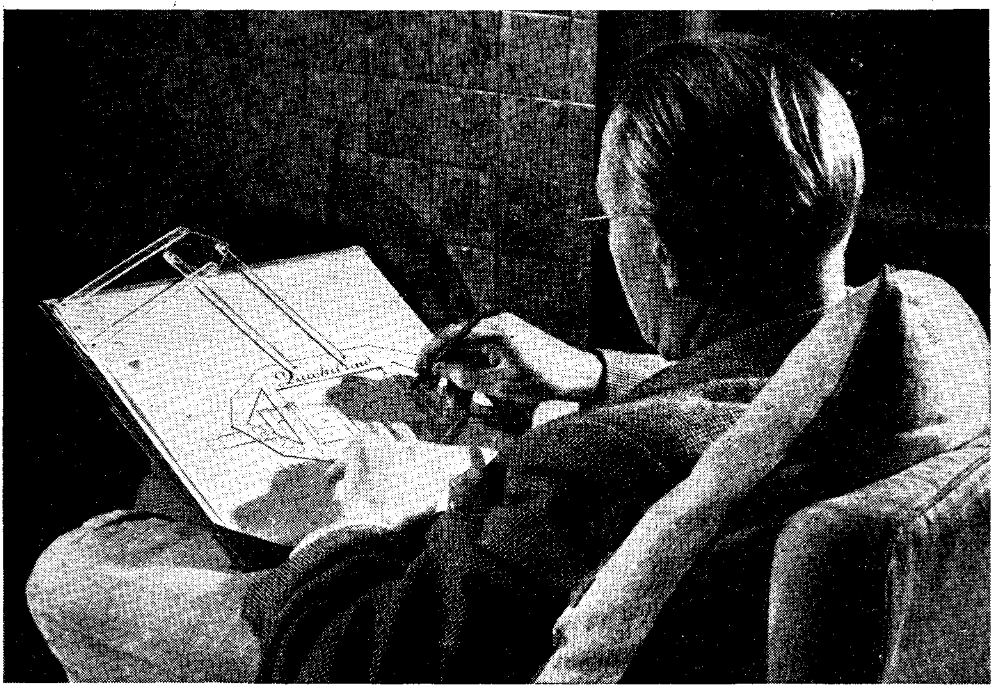
A HANDY DRAWING APPLIANCE

WHILE there are a few model engineers who declare (either in boast or apology !) that they never make drawings, we think that the great majority of our readers will agree that mechanical drawing is a valuable, and sometimes indispensable aid to all kinds of engineering. Those who do not make drawings may plead the excuse that in order to make them accurately, elaborate equipment is necessary, including at the very least, a cumbersome drawing board and tee-square, which may not readily be available to the worker who wishes to take advantage of brief leisure moments, often in odd places.

Several devices have been introduced to simplify drawing, but most of them suffer from the disadvantage that they add still further to the draughtsman's impedimenta, or impair accuracy. Neither objection, however, applies to the device illustrated here, which is undoubtedly an aid to speed in producing accurate drawings, and is so handy in use that it may quite conveniently be brought into action while the user is comfortably seated in a fireside armchair, or even in the train. A wide range of work can be carried out without the need for any additional instruments whatever, though the appliance can be used in conjunction with compasses, scales or protractors if desired.

Basically, the " Quickdraw " appliance consists of a light but rigid board contained in a folder or portfolio 14 in. square, to which is attached a pantograph with a template so shaped as to enable lines to be ruled horizontally, vertically, and at all principal angles, including those required for isometric or perspective drawing. Circles of several different sizes may be drawn with the aid of apertures in the template, and though this method may be open to criticism where the highest accuracy is required, it is certainly useful for drawing in radii and fillets connecting straight lines. Accurately spaced parallel lines and various distances apart can also be ruled from the template. Scales marked in inches and millimetres are provided on the horizontal and vertical ruling edges.

The maximum size of paper which can be used is 13 in. × 10 in., and only one drawing pin need be used to hold the paper, by utilising the corner pockets at the bottom of the board. In view of the usefulness of the appliance, its price is very reasonable. It is marketed by the Quickdraw Company, 127, Gunnersbury Avenue, London, W.3.

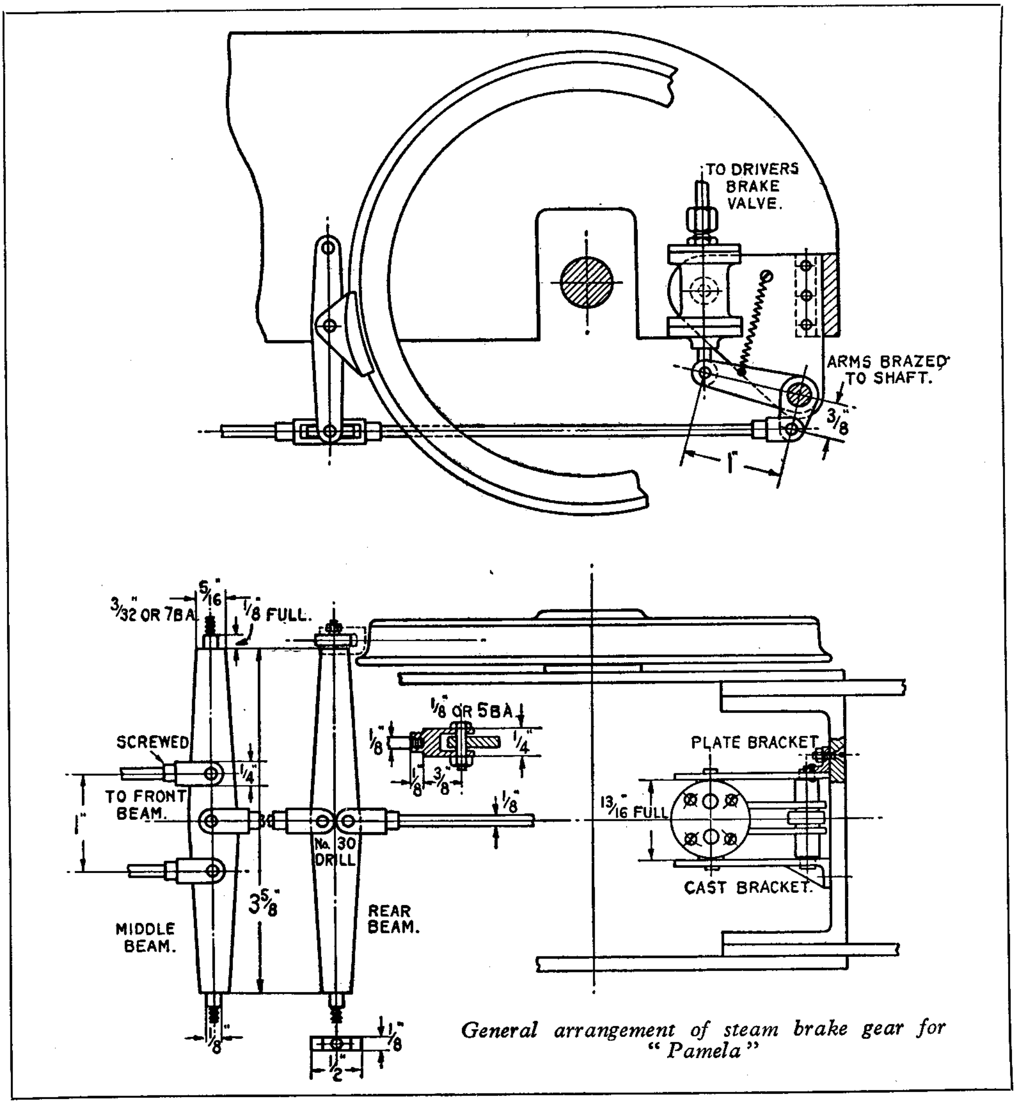


Drawing in comfort with the aid of the " Quickdraw " appliance

"PAMELA" by "L.B.S.C."

A 3½-in. Gauge Rebuild of a Southern Pacific

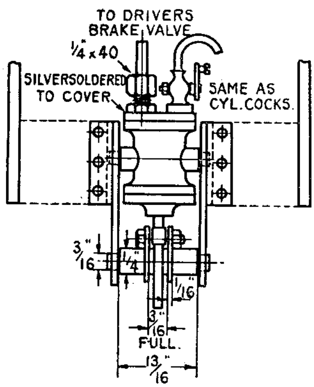
BEFORE giving details of a suitable steam-operated brake for *Pamela*, may I once more call the attention of beginners, and others not so well versed in full-size locomotive operation, that whilst the brake will work, *it must not be used for "service stops" when the engine is hauling loads of live passengers.* I thought I had made this quite clear on previous occasions; but judging from new readers' letters, a timely reminder is called for. All passenger trains are fitted with "continuous" brakes; that is, brake gear on every vehicle in the train, operated from the engine, either by compressed air (Westinghouse brake) or by atmospheric pressure operating against a partial vacuum in the brake cylinders (vacuum brake). Any passenger driver will tell you that the engine pulls the train, but the train stops the engine. In the old days before the train brakes were fitted, and the engine only had brakes, it meant shutting off



General arrangement of steam brake gear for "Pamela"

steam a couple of miles or more before reaching a station at which the train had to stop, and very careful handling of the engine brakes, to avoid locking the wheels (" picking them up " is the enginemen's term for it) and causing flat places to form on the wheel treads. For emergency use, the front and rear guards' vans were fitted with hand-brakes—hence the term " brake van " —and when the driver required their assistance to stop, he either sounded a special call on the engine whistle, or sounded the deep-note alarm whistle with which many engines were fitted. Drivers of loose-coupled goods or freight trains, even today, have to perform the same antic. The fitting of continuous automatic brakes to goods vehicles, is long overdue. The old, old excuse—" economy "—is still the obstacle, and likely to remain so; though in many other countries, notably U.S.A. and Canada, continuous brakes are compulsory on all rolling-stock, and freight trains can run at passenger-train speed.

In the case of *Pamela*, it would be useless to try and make a service stop with the steam brake; she would simply slide, and before long, the



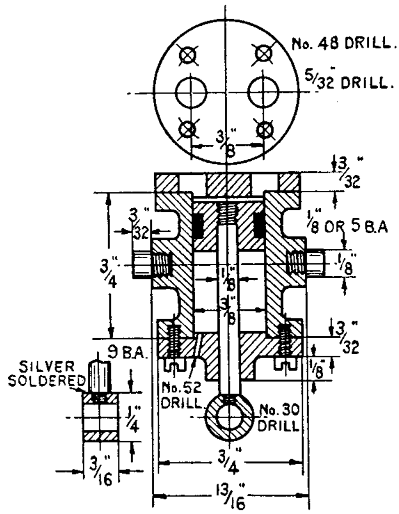
End view of assembly

wheel treads would be about as true as polysided nuts. On a locomotive of her size and weight, the trouble is aggravated to a far greater extent than it would be in full-size practice. A big engine's normal load is about four times its own weight; the little engines can pull much greater proportionate loads, and *Pamela* could tackle from fifteen to twenty times her tonnage, so it can easily be realised that the braking adhesion of the six-coupled wheels would be about as effective in stopping, as the driver putting his toe under the wheel of her full-sized relation. That is why we rely on hand-brakes on the passenger-carrying cars. I hope this makes it all clear to our newcomer and other inexperienced readers.

Brake Rigging

Whilst this is similar to that described for *Doris*, it is a bit simpler, as we haven't any ashpan to dodge, all the brake-gear being ahead of it. Holes have already been drilled in the frame to take the hanger pins, which are turned from ¼-in. round mild-steel, to dimensions shown. The longer screwed end of each pin, is pushed through the hole in the frame, and nutted inside, as shown in the end view of the assembly.

The hangers are filed up from ⅜-in. × ⅛-in. mild-steel, and drilled as shown. The brake blocks may be cast (our advertisers who sell supplies for this engine, may perhaps oblige) or they may be filed or milled from ½-in. × ¼-in. steel bar. I have explained, previously, an easy way to form the concave rubbing surface; briefly, it is to cut off the six lengths of bar, set them to a circle 4⅝ in. diameter, scribed on a piece of brass plate about ⅛ in. thick, solder them to the plate, bolt same truly to the lathe faceplate, and form the concave sides with a boring tool. I do the job on a milling machine, by putting the

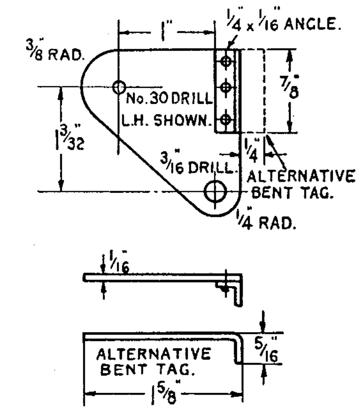


Section of brake cylinder

whole lot together, side by side, in a machine-vice on the miller table. If I haven't a cutter of the right diameter, I use a hefty fly-cutter in an arbor which fits the taper in the miller mandrel. The fly-cutter is adjustable for any diameter; both cutter and arbor were home made. A smaller edition could be used in an ordinary home-workshop lathe.

Drill the pinholes in the brake-blocks before slotting the backs. The latter job can be done by milling, planing, or just sawing and filing. To mill in the lathe, you only need a ⅛-in. saw-type cutter on an arbor or spindle between centres. The blocks are set in a machine-vice (regular, or improvised from bits of angle, as shown for *Tich* builders some time ago) at the correct height to cut the proper depth of slot at one go, and traversed under the cutter very slowly, using plenty of cutting oil if steel. Tip: I always use a paraffin-diluted cutting oil, but if water-diluted soluble cutting oil is used—some folk prefer it—always clean your lathe down directly after use. Otherwise, if it doesn't go rusty, it will

soon be all sticky, where the water has died out of the oil, and left a very unpleasant residue. Attach the blocks to the hangers with pieces of $\frac{1}{8}$-in. round silver-steel, then put the hangers on the pins as shown, and secure with nuts. Note: the blocks should be stiff enough on the hangers, to " stay put " in the same position when brakes are released, so that they don't lop over and rub



Cylinder and shaft bracket

on the wheels all the time; but the hangers must be quite free on the pins.

The beams are of the conventional " coffin " type, made from $\frac{1}{2}$-in. × $\frac{1}{8}$-in. flat mild-steel. No need to use any posh material for brake gear, it isn't done in full size, and ordinary black strip will do. The ends can be turned and screwed, with the pieces of steel chucked truly in four-jaw; file to shape after turning. Warning to beginners: don't screw the ends too far down. When the nuts are quite tight, the hangers should still be free to move easily.

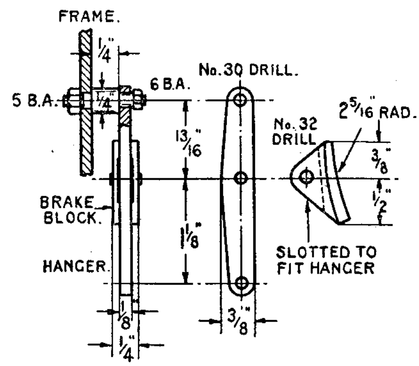
No compensating gear is required. On many full-sized engines, it is not fitted, as new blocks soon wear enough to take up any slight discrepancy in spacing, and soon bear evenly on all wheels; Stroudley didn't bother much about compensating, and we always managed to stop where we wanted! If anybody wanted to see what good enginemanship really was, they should have stood by the water crane at the south end of the down local platform at Norwood Junction any evening at the height of the homeward rush from the City. A little " D " class tank would come sailing in with nine crowded bogie coaches, or about sixteen four-wheelers, or maybe a mixed load; and with a " two-application stop," the driver would pull up exactly at the right spot for the engine to snatch a hasty drink (which she needed, after doing nine miles in thirteen minutes or so, including three miles of 1 in 100 up) whilst the passengers unloaded. They didn't practise any go-slow tactics in those days! However, getting back to the job, the beams are connected by simple pull-rods, merely lengths of $\frac{1}{8}$-in. round steel, with a fork at each end; the forks are made as described for valve gear and other parts, so no repetition is needed.

Note that while a single rod is used between second and third beams, twins are required between first and second, to clear the bottom union on the valve box of the pump. After it leaves the union, the water pipe can be bent, so that it clears the rest of the brake-gear. All necessary sizes are given in the illustrations.

Brake Cylinder and Shaft

The brake cylinder, also the shaft and levers, are similar to those specified for *Doris*, but the latter are simpler, as the pull is taken centrally. The brackets holding the cylinder and shaft are more simple, too, and are attached by the rear ends only, to the back cross-stay of the main frames, the whole layout being clearly shown in the illustrations. The brackets may be cut from 16-gauge steel, with pieces of $\frac{1}{4}$-in. × $\frac{1}{16}$-in. angle brass riveted to them, for attaching to the cross-stay. Alternatively, the angles can be dispensed with, and a tag left at the upper end of each, as shown by dotted lines, which may be bent around at right-angles in place of the separate piece of angle. It is also quite on the cards, that our approved advertisers may supply cast brackets, with strengthening webs in the angles; this would make the best job of all. Don't forget that you need one right-hand and one left-hand bracket.

The brake cylinder is " the simplest ever," as the kiddies would say, and merely consists of a cylinder body with top and bottom covers, piston, and rod. No steam chest nor valve to bother about! The casting will probably be solid, as it would hardly be worth while coring for a $\frac{3}{8}$-in. bore. It can be chucked truly in either three or four-jaw, faced, centred, drilled No. 30 for pilot hole, opened out to 23/64 in., and reamed $\frac{3}{8}$ in. The other end can be faced with the casting on a stub mandrel in three-jaw.



Brake blocks and hangers

The covers, piston, and rod, are machined and fitted in the same way as the engine cylinders. Drill a $\frac{1}{16}$-in. vent hole in the bottom cover. The trunnions are merely bits of $\frac{1}{8}$-in. silver-steel screwed into the side bosses, and the big-end is a $\frac{3}{16}$-in. slice parted off a piece of $\frac{1}{4}$-in. round rod which has been drilled No. 30 for a little over $\frac{1}{8}$ in. depth. The end of the piston-rod is

turned down to 3/32 in. diameter, screwed and fitted into a tapped hole in the thickness of the big-end. It may be silver-soldered in place, for safety's sake, as there is not much thread to hold it. The top cover carries a union screw for the steam-pipe connection, and either a cock, or a ball valve, to get rid of condensate water, both being silver-soldered to the cover. The cock is the same as those on the cylinders, and can be operated by a Bowden wire in similar fashion.

The brake shaft is a piece of ¼-in. round steel, reduced to $\frac{3}{16}$ in at each end, and works in plain holes in the brackets ; there is not the slightest need to bush the holes, as the brake is for show purposes only, like the breast-pocket silk handkerchief of the mid-Victorian "masher"—he kept a linen one in another pocket, well out of sight, for "blowdown" purposes! The two longer arms are cut from $\frac{1}{16}$-in. steel, and the shorter one from ⅛-in. steel, drilled as shown, mounted on the brake shaft, and silver-soldered or brazed in position.

How to Assemble

The assembly and erection is a simple job. The two brackets are attached, first of all, to the cross stay a full $1\frac{3}{16}$ in. apart. Either 3/32-in. or 7-B.A. bolts may be put through clearing holes in both cross-stay and angles, the brackets being held in place by a toolmaker's cramp whilst drilling the stay. Alternatively, screws may be put through clearing holes in the angles, into tapped holes in the stay. Put the big-end on the piston-rod, between the two long arms, and squeeze a piece of ⅛-in. silver-steel through the lot, filing off nearly flush at each side ; or use a bolt, just as you prefer. Now take off one bracket, put the cylinder and shaft in place, with the reduced end of the shaft, and the trunnion-pin on the cylinder, in their respective holes in the other bracket. Replace the first one, and screw up.

If you have not already done so, connect up the brake beams to the bottom ends of the hangers, and couple up the brake pull rods, with ⅛-in. bolts, to the beams. The back end of the last pull rod is attached to the drop arm on the brake shaft, also by a ⅛-in. bolt. Work the brake shaft with your fingers, and note that when the piston in the brake cylinder has completed about two-thirds of its stroke, all six blocks should be bearing against the wheel treads. If they are not, simply take the bolts out of the forks on the pull-rods, and screw the forks either on or off the rods, for a turn or two, as required. The brakes are normally kept in the "off" position by a spring as shown, one end attached to one of the longer levers on the brake shaft, and the other to the bracket, by a small screw, as shown. If a tyre-pump is coupled to the union on the brake cylinder, the brakes should "plonk on," as the enginemen say, with great alacrity when the pump handle is pushed down, and release equally well when the pressure is relaxed. All being well, I will describe how to make the driver's brake valve, along with the tender brakes.

If anybody prefers to fit the vacuum brake, the same rig-up does very well, and can be used with a simple ejector, and a diaphragm-type vacuum cylinder ; these will also be dealt with, along with the driver's valve. One great advantage in operating with either compressed air or vacuum, is that there is no condensate water to worry about, and no need to fit either drain cock or ball valve.

Erratum—*Pamela's* footplate is 7 in. wide, not 9 in. The drawing on page 134 in the January 25th issue is correct (half size), but the figure 9 should be a 7.

Drawings of Old Steam Engines

WE have received from Precision Models Co., High Road, Byfleet, Surrey, copies of drawings for two interesting types of old steam engines. In each case, the drawings cover the general arrangement and all details.

The first set is for a small beam engine of about 1840 ; it is based on an engine which is preserved in the Bridewell Museum, Norwich, and worked for about 90 years at a Kings Lynn brewery. The set consists of ten sheets, setting out the engine in side and end elevations, plan and all details, many of which are drawn twice full size for the model. As may be gauged from this, the model is a fairly elaborate one, but it is a very handsome one. The cylinder is $\frac{11}{16}$ in. bore by 1¾ in. stroke, and the beam is 5 in. long between centres ; the diameter of the flywheel is 7 in. There is a pump for the engine to work, in the proper manner, having a stroke of ¾ in., and there is provision made for the fitting of a suitable condenser ; if these two items are included, the model can be one of the most complete of its kind yet made possible for the enthusiastic constructor.

The second set of drawings, of which there are two sheets, depicts a very pretty little oscillating engine of 1851, based on one shown by B. Hick & Son, of Bolton, at the Great Exhibition in that year. The model has a cylinder with a $\frac{7}{16}$ in. bore and a stroke of $\frac{15}{16}$ in. ; it has a flywheel 3½ in. in diameter. All the details are clearly and conveniently set out.

To ensure the general correctness of these two models, the company commissioned Mr. G. K. King, of Norwich, to prepare the designs. We understand that castings are to be made available and that other designs are in preparation.

PRACTICAL LETTERS

Early Drummond Lathes

DEAR SIR,—Regarding the query in a recent issue as to how many of these lathes are left, I may say I have one in constant use which I purchased as a young man 45 years ago. As a matter of fact I still have Drummond Bros. receipt for the purchase price—£13 10s.—dated December 13th, 1905! Also, the original illustrated description. This lathe is in the exact condition as purchased, except for the addition of a micrometer dial on the cross-slide.

Even allowing for changed monetary values, I consider these lathes were marvels at the price and for accurate, sound and honest workmanship I have seen nothing to equal them today at three times the price. My lathe is still in practically perfect condition with no signs of shake anywhere. Of course, the adjustments have been taken up when necessary. The only serious wear is in the leadscrew at the headstock end where the slide-rest does most of its work. Traversing the slide-rest by means of the leadscrew was not a good feature and a fully compound rest was provided in later models. The central leadscrew also is liable to be fouled by swarf, which is very difficult to remove from the trough-shaped bed, but this trouble is easily avoided by keeping a cloth over the saddle while working. The smallness of the mandrel nose—$\frac{3}{4}$-in. Whit.—is also open to criticism. However, this lathe has given years of satisfactory service and is still capable of good work. I am at present building a Stuart Turner Triple Expansion Marine Engine and having some doubt as to the parallelism of the cylinder bores machined on the face-plate, I had them gauged in the Inspection Dept. of a local precision engineers. The report stated the bores were not round, but taper was "less than two tenths of a thou" I imagine the ovality error was of about the same order and mention this merely to show what these old lathes are capable of. Replying to Mr. Mather (January 11th issue) the set of change wheels as supplied with the lathe comprised eleven wheels plus one reverse wheel on stud.

Messrs. Drummond's descriptive list of 45 years ago contains the remark—"The workmanship throughout is of the very best"—After this somewhat lengthy trial, I can thoroughly endorse that statement, and would wish heartily to congratulate any of the old firm still surviving who were responsible for the design or construction of these sturdy and excellent little machines.

Yours faithfully,

Gloucester. CHAS. BLAZDELL.

Further Turning Points

DEAR SIR,—Having just come across another batch of loaned MODEL ENGINEERS, I read of interest the above subject in the December 14th, 1950 issue and note, of course, "Scotia's" comment on large lathes, by virtue of weight and size alone, work being done more satisfactory than a small lathe in good shape. I would like to mention for readers' benefit: When stationed in Agra (India, in 1943), I was attached to R.E.M.E. Workshops in the repair and overhaul of teleprinters (some of which were recovered from under the sea). However, one day I required 12 small jockey rollers machining, size being approximately $\frac{1}{4}$ in. to $\frac{5}{16}$ in. long × 3/32 in. thick with each end to a distance of $\frac{1}{16}$ in. turned down to about $\frac{1}{8}$ in. or maybe less. Imagine my amazement when I found the Sikh turner making my rollers on a lathe normally used for making back axles, etc., of Army vehicles, a lathe which had headstock in the centre and could machine two articles or jobs at one time! Yes, he had collet chuck fixed in the jaws of the normal chuck, I should say 15 in. or so. Sounds fantastic, but I daresay some who were there who read this will remember—who could forget?—a glass-roofed building and temperature at noon of 135 deg. in the shade inside the shed. Phew! June.

Incidentally, I was Signals (Royal Corps of) and really enjoyed my stay at these workshops, learning engineering other than electrical.

May I at this point congratulate you on a fine journal which I have pleasure in having loaned regularly.

Yours faithfully,

Huddersfield. DOUGLAS WARDMAN.

Rust Prevention

DEAR SIR,—After reading many letters on the "Prevention of Rust," I should like to pass on my experiences. My workshop is timber-built, the yard wall being one side. All joints sealed with "Bondex" and watertight, floor concrete. All inside surfaces painted with oil paint, heating by electric fire.

After using tools and machines, I apply a thin film of light motor oil with a soft paint brush, then cover over with a sheet of bitumen-lined brown paper.

Do not cover over with cloths, the fabric absorbs moisture then encourages condensation on cold metal.

Your grocer could fix you up with bitumen paper, in which he receives some of his dry goods.

Having resisted four years of Lancashire weather, I think I have solved the workshop rust problem.

Yours faithfully,

Bury. WALTER HEUPY.

Cotter Locks

DEAR SIR,—It is stated on page 33 of the Jan. 4th issue that the type of lock shown in Fig. 2 is "quite unsuitable" for applying to a tailstock mandrel, on account of the sideways thrust which it exerts when used. The type shown in Fig. 3 is apparently regarded as being superior in this respect, but surely its action is that of two wedges combining to create an upward thrust, which is "sideways" to the axis of the mandrel. The area of its grip on the mandrel is, of course, much greater than in Fig. 2 and this is a big advantage.

Yours faithfully,

Belfast. W. G. MARTIN